Engineering News-Record

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Penstock Gates of New Design for Calderwood Tunnels

By ADOLPH J. ACKERMAN

Flood Control on Alluvial Rivers—II

By FRED H. TIBBETTS

Electric Strain Gage For Measuring Concrete Stress

By E. C. EATON

ALSO:

Grand Rapids Meets Unemployment With Public Works

Sealing Bridge Cofferdam By Grouting

Rock Island Builds Direct Line To Kansas City

Tornado Damage at University of Missouri

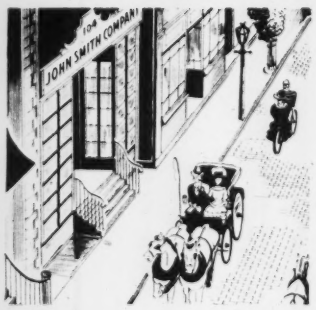
Simple Patching Method For Macadam Roads

Fall Meeting of Civil Engineers at St. Paul

Smooth-Safe – Yet it's 21 Years Old

St. Johnsville, N. Y.—Paved in 1910

BRICK is one of the oldest paving materials made by man. Yet it has been constantly improved. It has kept pace with the automotive industry — it has made high speed travel safe and secure.



As they are built today, brick surfaced pavements offer a new travel thrill — the same sense of smoothness which comes with travel by air. Driving is easier and safer. There's no glare from brick. You can relax while you drive. Just as the old brick surfaced pavements set records for durability and economy, so will those modern pavements being laid today. If pavements built while the automobile was in its infancy can stand up year after year under the grind of present day traffic, surely we can expect even more of the brick pavements now being laid. They are especially designed for heavy passenger car, truck and bus traffic.

Here is a typical example of brick pavement history. Through St. Johnsville, N. Y., runs the Mohawk Trail, a through highway. Paved with brick in 1910, the St. Johnsville stretch is in practically perfect condition today. Maintenance expense has averaged 3/5 of a cent per square yard. Such records for durability and economy can not be matched by any other paving material.

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BRICK PAVEMENTS

ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL OF CIVIL ENGINEERING AND CONSTRUCTION PRACTICE

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F. E. Schmitt, Editor

OCTOBER 15, 1931

Sounder Building

IT IS reported on excellent Washington authority that the credit relief measures suggested by the President last week were put forth only because panic conditions were rapidly approaching. Money has been hoarded for some months, in vast sums; banks had to maintain their funds excessively liquid, and usable credit was shrinking fast. Therefore the first of the suggested measures, formation of a mutual bank-credit corporation to make up for the failure of the Reserve System to stabilize banking is of most immediate effect. It is of course an emergency measure only, to be followed by banking reform. The second measure, which aims at a better realty credit system, is likely to prove more fundamental, and therefore of greater ultimate importance. If it can be made successful it will remove the chief obstacle to intelligent and well-adjusted construction. The plan of the National Association of Real Estate Boards to set up a mortgage discount bank (*ENR*, June 11, 1931, pp. 958 and 986) is moved into the spotlight again by the suggestion. But if real estate security is to be stable and sound it must rest on definitely known quality in construction. The recommendation of the Associated General Contractors for a system of certifying construction is therefore significant, so far as buildings are concerned. A system that will reasonably define the values of buildings, added to a free market for mortgages, would revolutionize construction. It would render stable and businesslike an activity that now is always a gamble and sometimes merely a racket. If the present opportunity to work out such a system is missed, one of the biggest potentialities of the depression will be lost.

Commendable Work

IT WAS a good piece of work that the Associated General Contractors did in expressing itself in unmistakable terms on business improvement and unemployment relief. Construction has been so much blamed for creating or intensifying the depression that it is quite in order for construction men to speak up and call for specific reforms. The recommendations made are valuable even though they do not constitute a coordinated plan; a plan involves setting up a working organization and a definite course of action, which was not done by the A.G.C. The value of the recommendations lies in their expressing tangible, aggressive thinking by leaders in the arts of construction, and in showing that contractors are ready to to their share in attacking current problems. Whether or not all the opinions and recommendations meet the test of economic criticism and feasibility is less material; at least they do not dodge issues or fail to place responsibility, as evidenced by the call for the banks to improve credit practices and stabilize the value of construction securities. Altogether, the Associated General Contractors' statement of principles controlling the recovery of construction and thereby improving general business enhances the standing of the organization.

More Work—More Engineers

ONE factor of unemployment-relief measures not yet fully understood is the need for highly intensive engineering work if emergency construction programs are to be started promptly enough to afford the intended relief. Attention is so greatly centered on the labor aspects of the actual construction work that public officials overlook the necessary technical preliminaries. This condition has led the Western Society of Engineers to address local, state and federal authorities, pointing out that before contracts can be let much engineering work is required in making surveys, investigations and designs and in preparing plans and specifications. As we have said repeatedly in recent weeks, the technical forces of public bodies are adequate only for the normal amount of work, so that unless these forces are enlarged the increased construction programs will surely be delayed. The Western Society's resolution asks that public authorities distribute this additional planning among private engineers, so that when appropriations become available the plans will be ready, contracts can be let and work can be started. Every passing week makes it more urgent that the vital necessity for intensive prosecution of planning be impressed upon all public authorities and public bodies, in the interest of effective relief.

Sell the Public

THE GRIP on gasoline tax funds by state highway departments must be continually tightened these days as other sources of public revenue continue to dwindle and authorities look ever more longingly toward these supplies. Those states lacking the good fortune to have gas tax funds protected by constitutional amendment are in a particularly vulnerable position. Among the states not so protected and yet surprisingly free from pressure is California. The principal reason, in the opinion of C. H. Purcell, state highway engineer, is to be found in a conscientious effort at public education built around a carefully studied program of future development. Showing the people how the necessary program for highway construction and maintenance for the next ten years is based on a complete utilization of all available funds is an essential of the scheme. With its attention fixed on a definite future development the public will resist

attempts of administration to defeat such a program. In the opinion of Mr. Purcell, state highway departments are too prone to point to what they have accomplished rather than stress the work remaining to be done. The logic of the conclusion is evident and its psychology decidedly in order. All highway departments could well afford to focus public attention on the essential highway work for the coming decade, which will require the full use of all gas tax revenue.

Notable Welded Gates

THE emergency penstock gates for the Calderwood hydro-electric plant in Tennessee are notable both as to design and method of fabrication. Because their service is required only at very infrequent intervals, and because quick action and closing under pressure were not essentials, the gates presented possibilities for economies in structural details and in setting not found normally in hydraulic gates of such great size. Full advantage was taken of these possibilities. Each gate is a curved steel diaphragm, with just enough steel framing to give it stiffness when supported from the top. A reinforced angle riveted to the outer edge gives added lateral stiffness and forms the gate seat. Except for the riveting of this ring the entire gate is a welded structure, including the $\frac{3}{4}$-in. warped steel plates which make up the diaphragm. Welding these plates introduced new and unusual welding problems and resulted in the development of special welding technique, including peening the welds and annealing at high temperature, which proved successful. The lessons learned in this work should prove of value in fields other than such highly specialized gate design.

Unwarranted Charges

MUCH newspaper publicity has been given the demands of a few disgruntled delegates at the Vancouver meeting of the American Federation of Labor for a congressional investigation of labor conditions at Boulder Dam. Failing from the start to unionize the job, and again failing to get anywhere with a strike disrupting the work last August, certain local labor leaders went to Vancouver and hurled sensational and wholly unfounded charges against the Department of the Interior and contractors alike from the convention floor. The Federation wisely decided to investigate before taking any stand. Likewise, the American public should learn the real facts of working conditions at the dam before forming an opinion. Payment of low wages, intolerable sanitary conditions, letting out a concession for the camp, working in terrific heat, paying $1 to $1.50 for meals, and a hasty awarding of the contract before the Bacon-Davis bill went into effect are the principal complaints made at Vancouver. The charges are preposterous. The canyon was hot, but the workers knew it. The contractors voluntarily raised the existing daily wage scale of the surrounding country from $3.50 to $4. The best equipped camp ever erected on a construction project is found at Boulder Dam. The men are charged $1.35 per day for board, plus 25 cents for single rooms equipped with real beds. A commissary company does not hold a concession; it merely operates the camp under the direction of the contractor. Last summer's heat was intolerable, but that was hardly the fault of the contractors or the government. And lastly, the Bacon-Davis bill applies to federal buildings only and not to other types of construction. Six Companies, Inc., and the Bureau of Reclamation are both to be commended for the excellent manner in which labor is being taken care of on this huge project; to charge that they oppress labor is untrue and unfair.

Familiarity Breeds Contempt

ONE of the most discouraging human traits, from the viewpoint of safety and common sense, is the contemptuous disregard of ordinary precautions exhibited by the worker long subjected to occupational hazards. A powder man, watching a steelworker ride the hook skyward, expresses his opinion of such foolhardiness freely as he tosses an extra stick of dynamite back into the box six feet away. A laborer who would laugh to scorn a fellow using a match to investigate the contents of a gasoline tank thinks nothing of entering an unventilated manhole while smoking. Such actions are not the result of ignorance, for their unpleasant potentialities are thoroughly understood; they simply express the tranquil belief of the average man that nothing can happen to him on familiar territory. Last week's news pages told of the death of two workmen in the explosion of a sludge digestion tank at the Woonsocket sewage-treatment works. As nearly as can be determined, the accident occurred because a man attempting to examine the interior of the tank struck a match. It is true that the tank had been ventilated and contained only a small amount of well-digested sludge, but every operator knows that ventilation may increase, rather than decrease, the explosion hazard and that a sewage tank, like a gun, is always loaded. When closed sewage tanks were first coming into general use, an epidemic of explosions impressed the gas hazard upon the minds of operators to such good effect that few such accidents have occurred since. Now, apparently, the effect of that lesson is fading. Will the Woonsocket experience serve to remind operators of the need for caution, or will other plants suffer similar unfortunate experiences?

Public-Works Relief—The Other Side

WORK for all can be provided by an intensive public-works program this winter, we said editorially six weeks ago. Our reason was that work is better than charity, and costs no more.

Some people do not believe in relief by public works, however. To give the readers of *Engineering News-Record* the benefit of their opinion we quote passages from two recent editorials which oppose the public-works plan.

From the RAILWAY AGE

Synopsis: Public-works plan is viciously unsound. Private business is responsible for unemployment. Private business should provide increased employment.

The continuance of the depression is causing many suggestions to be made for reducing unemployment. Some of the proposals for having employment so provided by government as would reduce the employing power of private industry come from surprising sources. The following quotations are taken from an editorial recently published in a leading engineering paper: "Shall next winter's unemployment emergency be relieved by work or by charity?" . . . Increased government employment of public works would increase business in the particular fields that this publication happens to serve.

. . . There is so much unemployment because employment has been reduced by private business. Employment has been so much reduced by private business because the total earnings of private business have declined so much that it has been necessary drastically to reduce every expense that can be reduced. . . .

It may be said that the highways, waterways, buildings and other public works upon which the proposed expenditure of the taxpayers' money would be made are needed. But are they all actually needed now? And are not equivalent expenditures for improvements and maintenance in private industry much more needed? . . . Why not advocate a huge increase in taxes to be distributed as a subsidy among all the private industries of the country to enable them to spend more for improvements and maintenance and thereby increase employment? The natural answer is that if the money were distributed as subsidies to all private industries it would, in large measure, be handed back to the very industries from which it was taken, and that it would not help them to increase employment merely to take their money and then hand it back to them. But if it would not help them to hand their money back to them, how would it help them to have the government hand it over merely to those who construct highways, waterways and public buildings? . . .

The whole theory is viciously unsound and economically destructive. Private business, and not government, should provide increased employment. —*Railway Age, Sept. 19, 1931.*

From the WALL STREET JOURNAL

Synopsis: Public-works relief not physically possible. Would affect the credit structure. Buy now!

It may be doubted whether all those benevolent persons who urge the issuance by the federal government of billions in bonds to finance a vast public-works program for the sake of the unemployed realize the impracticability of their plans. There is little chance that Congress will be persuaded to a course so loaded with risks of waste and graft and so nearly certain to depress all existing investment securities, with extremely troublesome consequences to the entire credit structure. . . . It ought to be well understood that a new billion-dollar federal construction program, whether of buildings or of roads, could not possibly be got under way rapidly enough to afford widespread relief before next spring at the earliest. . . .

First and foremost among rational measures of relief is a freer expenditure by the many who have the means at their command to buy more of commonplace necessities, to hire more personal service, to make more repairs and replacements in their households. . . . Another result would be a keener realization by those who have means to give of their responsibility toward their local relief movements. . . . But the main thing to remember is that a so-called prosperity loan on the national credit is an actually unworkable program, so far as the requirements of the coming winter are concerned.

—*Wall Street Journal, Oct. 1, 1931.*

By comparing these statements and arguments with our editorials "An Emergency Ahead" (*ENR*, Aug. 20, p. 281) and "Work for All" (*ENR*, Sept. 3, p. 357), the reader will be enabled to form his own conclusions.

A Plan That Works

GRAND RAPIDS' unemployment relief plan at work presents the appearance of a smoothly functioning business organization. A great deal of its success in operation is due to the efficient administrative machinery that has been set up. A policy of creating public improvements through relief work is not enough; there must also be adequate organization. That developed in Grand Rapids serves well. While all its administrative detail could not be adopted bodily by another community, great value can come from the study of the plan, because it works.

Of course the plan has limitations. After all, any such program can be successful only in proportion to the funds available for its financing. In Grand Rapids advantage was taken of a charter provision which allowed a certain sum to be raised by bond issue on the authorization of the council alone for the relief of the citizens during times of calamity. That provision has been interpreted to include the present depressed economic conditions. Even though the funds made available thereby have been used to excellent advantage, their end is in sight. Some time before the end of the year the bond-issue funds probably will be exhausted. There is a possibility that they will be augmented by another bond issue approved by the voters, limited in amount only by the total credit position of the city. There is a further possibility that public-works contracts can be let in sufficient volume to care for the situation in another way, though contractors can hardly be expected to favor the employment of furniture makers at the expense of their own more skilled help.

It should also be noted well that the focus of the Grand Rapids plan is upon relief rather than upon public improvements. Such increases in civic amenities as resulted from the plan were a mere byproduct of relief. This orientation is justified during periods of acute emergency, but means that after all the plan remains a charitable undertaking. It should be considered in that light.

The Teaspoon Plan

THE brightest thought of legislators on how to increase employment by public-works construction is, *Return to hand labor.* A recent proponent of this idiocy is State Senator Burchill, of New York. In a bill introduced a few weeks ago at the extra session of the state legislature the Senator provides that two sets of bids shall be received on every contract, one for performing the work "by machinery and labor-saving devices" and another for performing it "by manual labor without the employment of machinery and labor-saving devices." It is recognized that hand methods will cost more, and so the bill provides that the state shall pay from a special appropriation "the difference between manual-labor cost and the estimated cost by the use of machinery and labor-saving devices."

No legislation could be more ill advised for the public interest. Bad as it is, there are indications that it has caught the popular fancy. Organized labor has already expressed its kindly regard. There are clear indications that the bill will be reintroduced at the coming regular session of the legislature, with a fair chance of passage. If the public is to be saved from another farcical undertaking for relieving unemployment vigorous opposition will be necessary.

What the bill proposes to do is to cast overboard the construction progress of a century—to penalize by the excessive cost of antiquated methods all sacrifice and effort by the public to undertake public works to help the jobless. It disregards wholly the fact that construction by "machinery and labor-saving devices" carries back the train of employment from the construction job into the store of the distributor and the shops of the manufacturer and the activities of all who supply him the means for creating his product. It lacks definition which would make alternate bids comparable. It would throw construction practice into chaos and would make public works a farce and a failure as a means of relief of unemployment. In intent it would replace steam shovels by teaspoons, and trucks or even wheelbarrows by the earth-carrying basket of the coolie.

Lightness and Low Cost Obtained by New Penstock Gate Design

Radical departure from normal hydraulic gate design adopted for emergency gates in the pressure tunnels at Calderwood dam in Tennessee—Difficult fabrication and welding problems overcome

By ADOLPH J. ACKERMAN
Hydraulic Designing Engineer, Aluminum Company of America, Pittsburgh, Pa.

EMERGENCY gates for use during repairs to the butterfly valves of the Calderwood hydro-electric plant were considered desirable in preparing the designs for the project. A large expenditure such as would be required for normal gates large enough to close off any one of the three 16-ft. diameter penstocks did not, however, appear to be warranted, as the gates would only be required infrequently. Hence a satisfactory gate that could be built at low cost and could be maintained at a minimum of expense was sought. The gates described herein were the result of studies to that end. The design is new. It combines lightness with extreme simplicity and low cost. Further, the successful attempt to employ welding in the fabrication of the ellipsoidal plates used for the gates in order to save weight brought out valuable information as to methods to be employed in welding curved plates.

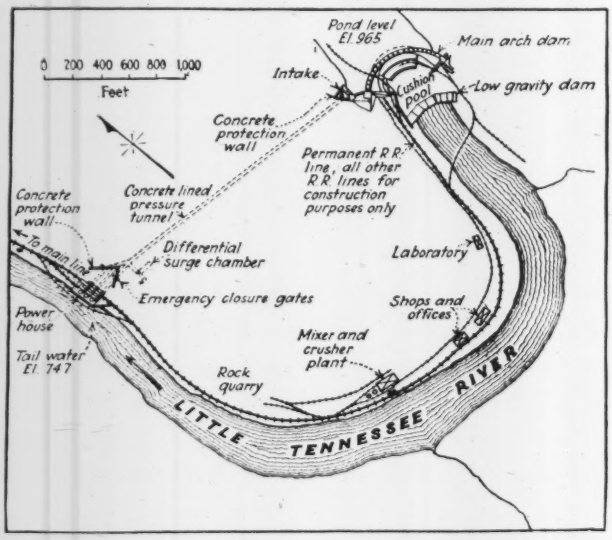


Fig. 1—Plan of the Calderwood hydro-electric development

The Calderwood project is located on the Little Tennessee River near Knoxville, Tenn. It was described in *Engineering News-Record*, Dec. 19, 1929, p. 954, and Oct. 30, 1930, p. 684. A general plan of the development is shown in Fig. 1. Water for the turbines enters an intake, controlled by a sliding gate, at the dam, and passes through 2,100 ft. of 26-ft. diameter concrete-lined tunnel, which branches into three 16-ft. diameter concrete-lined penstocks near the power house. Each penstock is connected to its corresponding 56,000-hp. turbine by a 16-ft. diameter steel tunnel liner, incased in concrete extending 275 ft. back into the mountain. The water for each unit is controlled by 16-ft. diameter butterfly valves located in the power house and operated from the switchboard. For a general shutdown or periodic inspection the intake may be closed and the entire tunnel unwatered.

In preparing the designs for the project it was felt that for the contingencies of repairing or replacing the seals on any one of the butterfly valves or making other major repairs thereon some emergency means should be provided for isolating any tunnel branch, while permitting continued operation of the other two units. It was also considered probable that such an emergency closure scheme would prove advantageous in the case of extensive repairs on a turbine, as it would avoid the necessity of depending upon maintained pressures in the rubber sealing tubes of the butterfly valve to keep the scroll case dry, thus offering greater safety to the workmen.

The principal requirements of the emergency closure system were dictated by the infrequency of operation, which demanded a low initial investment, maximum simplicity and ability to operate without power by requiring only two or three men for manipulating the closure device. For the comparatively high head and large diameter none of the usual types of gates met these requirements satisfactorily. Finally the idea of adapting the hemispherical bottom commonly found on elevated water tanks was suggested by James P. Growdon, assistant chief hydraulic engineer of the Aluminum Company of America.

The task of applying this principle and preparing a final design was given to the writer; and after developing an improved shape, which is fully described later, the design shown in Fig. 2 was finally adopted. It consists essentially of an ellipsoidal gate normally stored in concrete-lined pockets adjacent to the penstock inlets. After the intake has been closed and the tunnel unwatered two men can readily roll the gate into place on the overhead trolley rail, after which the plant is again placed in service and work can proceed in the empty penstock. One gate is provided for each penstock line. The location of the closure points in the branches was defined by the upstream ends of the steel liners, which serve as bearing seats for the gates.

Design of Gates—An analysis of the stresses in a dished plate under load is not readily available, although such a study was made nearly 30 years ago by A. N. Talbot. ("Derivation of Formulas for Stresses in the Curved Bottom of Tanks," *Technograph*, University of Illinois, Vol. 16, 1901-02.) A more recent analysis is

found in Timoshenko's "Strength of Materials," p. 510. For convenient reference, the principal equations are reproduced below, using the following nomenclature: (A gate in a vertical position will be considered.)

W = total normal load, in pounds, on gate.
p = unit pressure, in pounds per square inch, on gate.
R = radius of sphere or segment thereof, in inches.
r = radius in inches of circle formed by a plane intersecting a sphere or ellipsoid.
r' = major local radius on any point of an ellipsoid, in inches.
r'' = minor local radius on any point of an ellipsoid, in inches, at right angles to (r').
f = unit tensile stress in plate, lb. per sq.in.
S = total stress at edge of dished gate, in pounds.
t = thickness of plate, in inches.
C = hoop compression at edge of dished plate, in pounds.
ω = angle between axis of spherical segment and spherical radius to edge of segment, in degrees.

In a hemisphere the stress at any point in the plate is

$$f = \frac{pR}{2t} \qquad (1)$$

$$C = 0 \qquad (2)$$

In a spherical segment (f) is the same as in equation (1); but

$$C = \frac{W \cot \omega}{2\pi} \qquad (3)$$

In an ellipsoidal gate the stress in a circumferential direction is

$$f = \frac{P}{t}\left[r' - \frac{(r')^2}{2r''}\right] \qquad (4)$$

and in a radial direction

$$f = \frac{P\,r'}{2t} \qquad (5)$$

In designing the gate a maximum head of 260 ft. was assumed; this includes surge and water hammer.

The selection of the gate shape was one of the most interesting features. A hemispherical gate is structurally the simplest and has the lowest die cost for forming it, but it requires excessively large storage pockets; the segment of a hemisphere had a low die cost, but the hoop compressive stresses at the edge required expensive castings; an ellipsoidal gate, for which

$$C = f = 0 \text{ when } r'' = \frac{r'}{2} \text{ from equation (4)} \qquad (6)$$

permitted the use of a shallower structure without introducing serious hoop stress, but it involved a higher die cost on account of the varying radius. A compromise was finally reached by adopting a modified ellipsoid, shown in Fig. 3, which consists of a segmental spherical shell and a segment of a torus, the shape of the latter being defined by equation (6). As a result only two die shapes of simple radii were required.

The remaining features of the gates are comparatively simple. The heavy circumferential angle transmits the total thrust of 3,500,000 lb. into the edge of the supporting penstocks and contains a special rubber seal. The entire gate is suspended from an overhead trolley running on a curved track that leads into the storage pocket (Fig. 2). Special lightweight removable panels cover the pockets and form a surface continuous with the face of the circular tunnel to prevent turbulence in the water, which would otherwise cause a permanent loss of head at the gate recesses.

The weight of a complete gate is 14,000 lb., and the average price of all bids was found to be well below $4,000 per gate, which included a special pressure test, as will be described later. It is interesting to note that a riveted job throughout with double-butt straps would have added 8,000 lb. to each gate.

Fabrication—Plates for the gates were pressed in a set of temporary dies built up of welded parts, and they were then assembled on a wooden frame. The welding was done with 225 amp. at 19 volts, using a continuous electrode manipulated by hand but fed from an automatic regulator that was actuated by the slightest change in voltage across the arc. The welding together of warped plates that are inherently rigid surfaces presents many difficulties. It was soon found that carrying the welding operations as a continuous process from one side to the other would introduce cumulative distortion from the uneven heating and would produce a warped structure. The plan was therefore adopted of tack-welding the plates together and then closing short sections on various points of the gate so that the distribution of heat was more or less uniform. However, when the closing joints were subsequently made, particularly at the intersection of the radial joints with the circumferential, called T-joints, the plates would close under the heat of the arc, and, being under full restraint by the adjacent beads, would crack open upon cooling. An effort was made to prevent such cracking by peening the welds back as they cooled. Strain-gage measurements taken between points spanning the weld indicated the extensive benefits of such a procedure.

Special Tests of Restrained Plates—Strain-gage measurements made directly on the gates were subject to numerous errors introduced by fabricating stresses, and it was there-

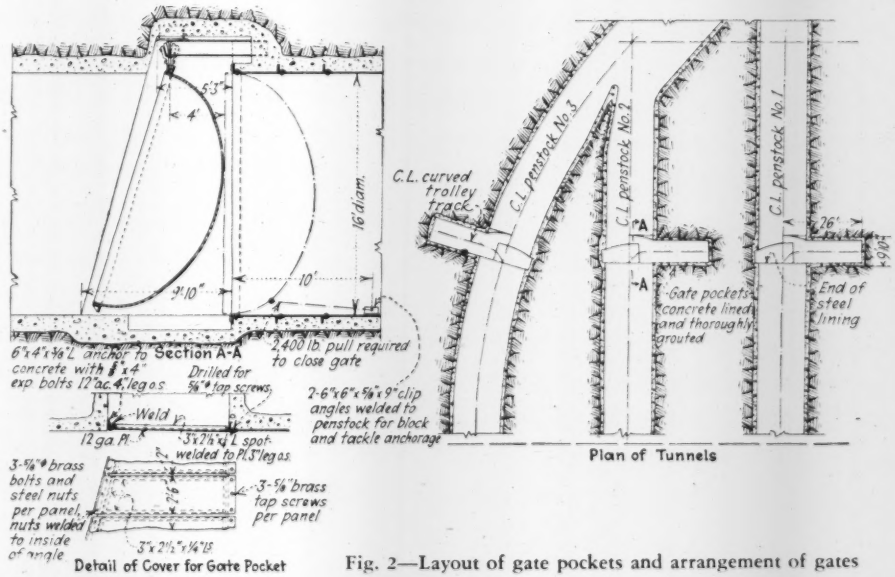

5'3"
4'
16' diam.
3'10"
10'
6"x4"x⅜"L anchor to concrete with 8 1"x4" exp. bolts 12" c. c. legs
Section A-A
2,400 lb. pull required to close gate
Drilled for ⅝" tap screws
2-6"x6"x⅝"x9" clip angles welded to penstock for block and tackle anchorage
Weld
12 ga. Pl.
3"x2½"x¼" L spot-welded to Pl. 3 legs
3-⅝" brass bolts and steel nuts per panel, nuts welded to inside of angle
3"x2½"x¼"L
3-⅝" brass tap screws per panel
Detail of Cover for Gate Pocket
C.L. curved trolley track
C.L. penstock No. 3
C.L. penstock No. 2
C.L. penstock No. 1
A
A
Gate pockets concrete lined and thoroughly grouted
End of steel lining
26'
Plan of Tunnels

Fig. 2—Layout of gate pockets and arrangement of gates

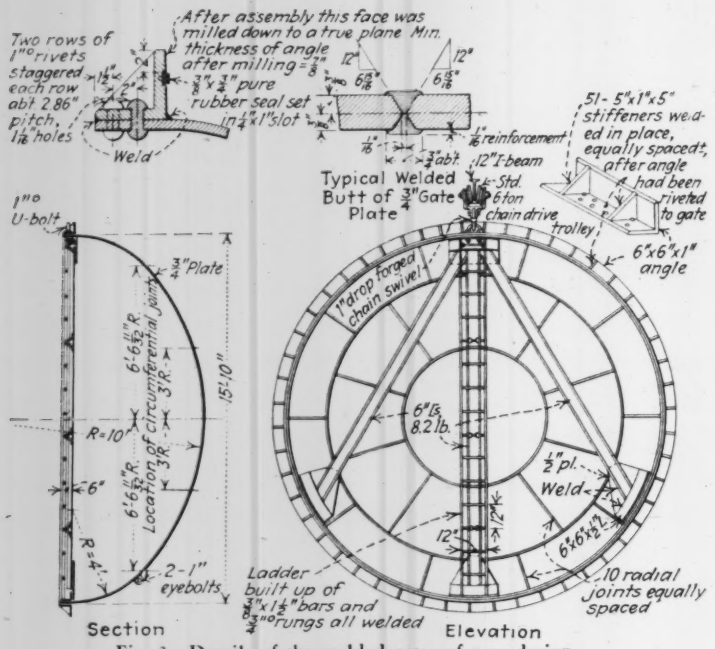

After assembly this face was milled down to a true plane Min. thickness of angle after milling = 7/8"
Two rows of 1" rivets staggered each row abt 2.86" pitch, 1 1/16" holes
3/8" x 3/4" pure rubber seal set in 1 1/4" x 1" slot
Weld
12"
6 5/16"
1/16" reinforcement
3" abt.
12" I-beam
51-5"x1"x5" stiffeners welded in place, equally spaced, after angle had been riveted to gate
Typical Welded Butt of 3/4" Gate Plate
Std. 6 ton chain drive trolley
6"x6"x1" angle
1" drop forged chain swivel
1" U-bolt
3/4" Plate
6'-6 11/32" R
Location of circumferential joint
3" R.
15'-10"
R=10"
6"
6'-6 11/32" R
R=4"
2-1" eyebolts
6" ctrs 8.2 lb.
1/2" pl.
Weld
12"
6"x6"x1/2"
10 radial joints equally spaced
Ladder built up of 3/4" x 1 1/2" bars and 3/4" rungs all welded
Section
Elevation

Fig. 3—Details of the welded gates of new design

fore found advisable to seek more reliable basic data on the effects of peening by preparing some special plates welded according to standard shop practice which could be subjected to similar tests free from fabrication stresses. The arrangement of the test plates and the results obtained are shown in Fig. 4.

The joint was identical with the one used in the gates, consisting of four layers of weld, or beads. Plate No. 3 was welded with strain-gage readings taken after each bead, but with no peening. Plate No. 2 was made similarly, but after each layer the weld was peened for 2 min. with strain-gage readings taken at intervals during the peening. Gage readings were in all cases taken after the specimen had cooled to room temperature. A 2-in. Berry strain gage was used, measuring deformations to 0.0001 in.

The results of the strain-gage readings and the effect of peening are shown graphically in Fig. 4. Supplemental tests were made upon tensile specimens taken from the plates at various points, at which time the relief of restraining action in the plates was also measured.

The following data were obtained from this investigation:

1. Large movements or change in length of gage lines over the joint take place during welding. They are caused by a combination of factors and are therefore not readily reduced to stress in pounds per square inch.

2. In the fixed type of joint high-tension stresses are induced in the base metal adjacent to the weld, in the present case reaching 20,000 lb. per sq.in.

3. Peening is beneficial in that it tends to relieve at least some of the strains induced by welding and to make the weld metal more ductile.

4. With peening operations proceeding simultaneously on both sides of a joint and using heavy calking hammers under air pressure of 100 lb. per sq.in., the greatest relief occurs during the first 2 min., and very little occurs after 4 min. of peening. Opposite the tips of the T-joints on the gates a stress relief of 16,000 lb. per sq.in. was measured.

5. The ductility of the weld metal is greatly increased by annealing at 1,600 deg. F., showing the following characteristics as compared with an unannealed weld: elongation raised from 5.5 per cent to 13 per cent; yield point reduced from 42,000 to 30,000 lb. per sq.in.; ultimate strength reduced from 64,000 to 55,500 lb. per sq.in.

6. Heating welded bodies at relatively low temperatures (300 deg. F.) over a considerable period of time (54 hours) is ineffective in relieving strains.

As a result of the investigation a satisfactory technique of welding was developed, and peening of the beads prevented cumulative distortion of the plates. By completely welding all radial joints first and then assembling the two rings and head plate with subsequent staggered welding of the circumferential joints, the difficulty of closing the T-joints was avoided. As a final measure the T-joints were reinforced on both sides with an extra bead for 8 in. in each direction, and the gates were then annealed at 1,200 deg. F. for three hours.

In order to assure that the rivets and welding beads on the circular seat angle would act together, the rivets were heated only to a cherry red and squeezed down

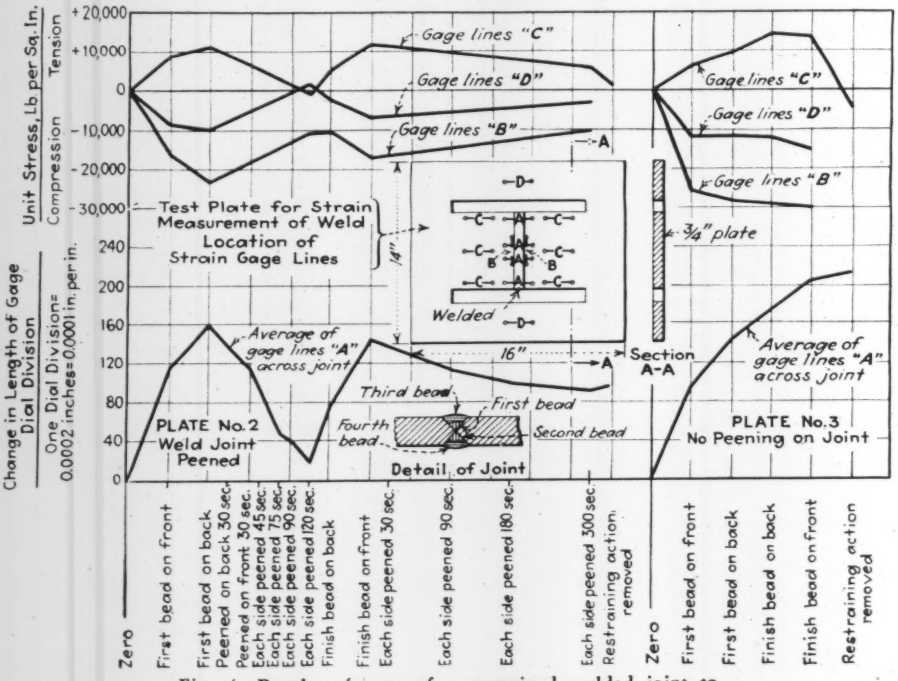


Fig. 4—Results of tests of a restrained welded joint to show the effect of peening

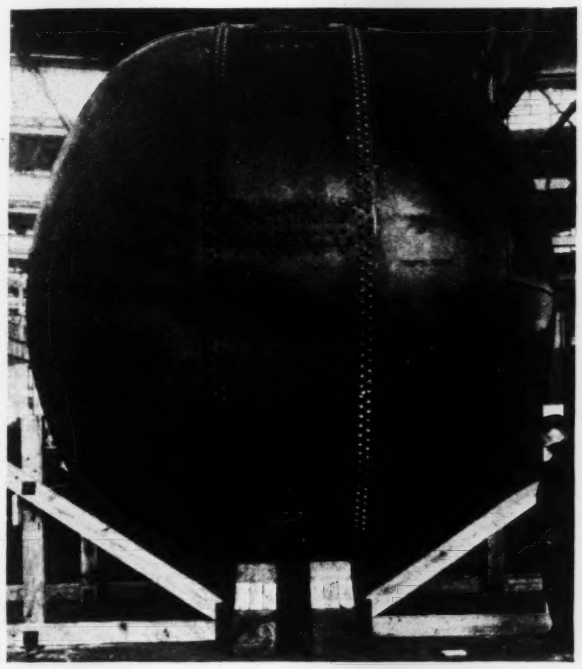


Fig. 5—Two gates being subjected to a pressure test

to position under a single stroke of a 125-ton press.

Shop Tests and Strain-Gage Measurements—As a check on the theory of design and also as a safety measure, provisions had been made for testing all three gates under full hydrostatic pressure of 260 ft. of head and at an overload point of 300 ft. of head. In the meantime the experiences encountered during the welding made it desirable to test the joints at 175 per cent of maximum possible operating pressure, and the final test pressure was therefore raised to 414 ft. of head, or 180 lb. per sq.in.

Two gates were tested at a time, being connected by a short ring, as shown in Fig. 5. A manhole in the ring section provided access to the interior. The pressure was supplied by a slow-speed reciprocating pump driven by air pressure. About 50 gage points had been drilled into the face of one gate for stress measurements with a 2-in. strain gage. A double set of zero readings was taken with the tank empty, followed by stress measurements with the vessel full but at zero pressure, then at 44, 94, 134, 156 and 180 lb. per sq.in. pressure, and again at zero pressure. The results of the strain-gage measurements are shown graphically in Fig. 6. The following information was obtained from these tests:

1. No measurable stresses were indicated with the tank full at zero pressure. This is the most serious condition for a cylindrical tank, but in this case the natural rigidity of the gates was sufficient to keep the cylindrical ring from being stressed very much, even at the saddle.

2. The measured stresses are in most cases less than those theoretically computed. However, it must be conceded that the degree of accuracy of the stress determinations is not of the highest because of inability to arrive at average measurements from readings on both sides of the plate. The results are considered accurate within plus or minus 2,000 lb. per sq.in.

3. At point 20 (Fig. 6) the stresses should be the same as at the adjacent points. The dip in the curves is due partly to the gage line spanning a weld, and principally to an indicated misalignment of the plates on each side of the joint, which caused local bending moments.

4. The independent action of the segmental torus is clearly indicated by the relation of radial and circumferential stresses at points 26, 27, 27*x* and 29*x*. The circumferential compression at 27*x* induces a reduction in the radial stresses, which is carried into the spherical segment.

5. Readings taken at zero pressure again indicated a complete relief of stress and no permanent set.

6. A final set of strain-gage readings was taken after annealing the gate at 1,200 deg. F. These indicated no local change, but it is obvious that internal strains of the structure as a whole were relieved.

In addition to the strain-gage tests, a severe hammer test was applied to all welded joints at pressures corresponding to 300 ft. of head, and again at 414 ft. A 4-lb. maul was used with such force that a strain gage held to the opposite side of the tank registered instantaneous stresses of 21,000 lb. per sq.in. Part of the registered deflections was, of course, due to the shock of pressure waves carried through the water, but the consistency of the results made it evident that high stresses were developed in the tank in addition to those due to the internal pressure. The welds withstood this severe test perfectly with the exception of the last blow (at 414-ft. head) directed on a T-joint, which caused a break about 7 in.

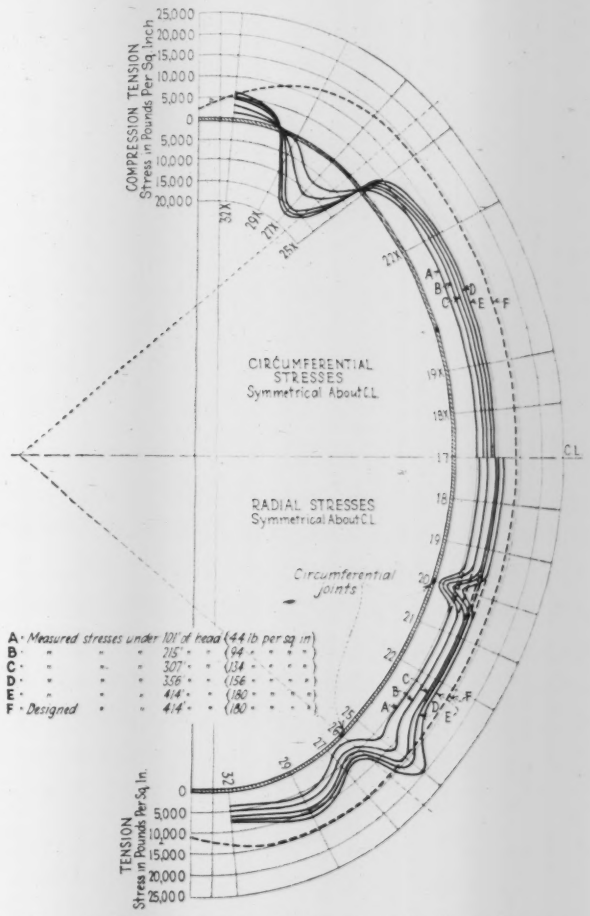

COMPRESSION TENSION
Stress in Pounds Per Sq. Inch
25,000
20,000
15,000
10,000
5,000
0
5,000
10,000
15,000
20,000
CIRCUMFERENTIAL STRESSES
Symmetrical About C.L.
RADIAL STRESSES
Symmetrical About C.L.
Circumferential joints
C.L.
A - Measured stresses under 101' of head (44 lb per sq in)
B - " " " 215' " (94 " " ")
C - " " " 307' " (134 " " ")
D - " " " 356' " (156 " " ")
E - " " " 414' " (180 " " ")
F - Designed " " 414' " (180 " " ")
TENSION
Stress in Pounds Per Sq. In.

Fig. 6—Stress diagram of two gates from strain-gage readings while under shop test

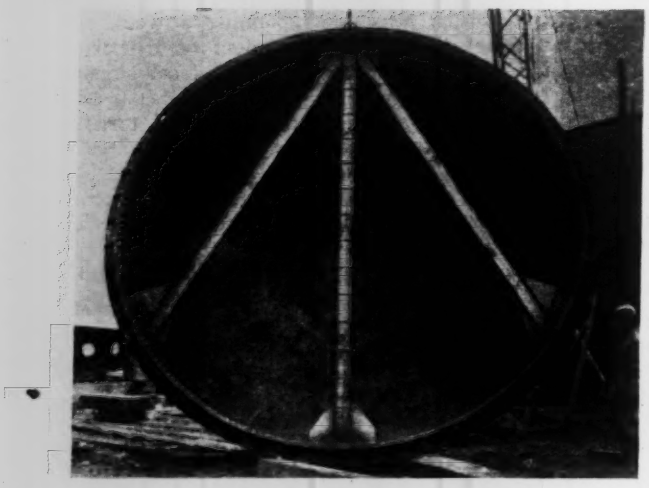


Fig. 7—The gates are simple and remarkably light

long. The break occurred on the circumferential part of the T-joint at point 27*x*, the point of natural maximum stress, but it was evident that the failure was started by a hair crack in one of the first beads, which had remained unnoticed during fabrication. It is significant that the full pressure was maintained for some time while a thin stream of water spouted through the crack, but there were no signs of raveling in the adjacent joints. It is interesting to note also that at the maximum test pressure each gate, as an individual hydraulic structure, was supporting a load of 5,100,000 lb.

Field Erection and Assembly—The gates were shipped in one piece in special well cars. The assembly of the upstream ring of the penstocks, with the seat angles, was accomplished by laying the gates face down and using them as templets to which the bearing edges of the penstocks were matched. The upstream stiffener angle on the penstocks was set back slightly from the edge of the ring plates, so that practically all of the thrust from the gate is delivered directly to the plates, and the bearing angle on the gate is subjected to a correspondingly reduced moment.

The gates were painted with bituminous enamel after being suspended in position, and the trolleys were packed in a heavy coat of grease.

Conclusions—The selection of a modified form of ellipsoid to simplify fabrication of the gates has been fully justified. The gate in the penstock of future unit No. 3, subjected to a static head of 180 ft., has been in satisfactory service for more than a year and has remained absolutely watertight. Tests after erection indicated that the handling system of the gates has met every expectation as to ease and simplicity.

The fabricating experience has demonstrated the value of peening a welded joint that is likely to develop internal strains during the welding process and has indicated the advisability of using a larger center plate in the gate, up to 120 or 130 in. in diameter, in order to reduce the number of joints to a minimum. Some steel companies are prepared to make and form plates $\frac{3}{8}$ in. and thicker, up to 144 in. in diameter. The welding strains avoided by such an arrangement are far more of a problem than the pressing strains in the larger plate.

The thickness of plate in the gate was chosen as an arbitrary minimum on account of various unknown factors, but it is evident from the stress determinations that under similar circumstances in the future a considerable weight reduction can be effected.

Personnel—The emergency closure gates were fabricated at the Riter Conley Works of the McClintic Marshall Corp., which cooperated generously in making the various test specimens and strain-gage observations. The gates were pressure-tested by the writer. Strain-gage measurements were made by the research laboratory of the Aluminum Company of America, New Kensington, Pa., under the general direction of R. L. Templin, chief engineer of tests, with C. Braglio, F. M. Howell and C. Dumont conducting the work. The Calderwood development was built under the general direction of James W. Rickey, chief hydraulic engineer of the Aluminum Company of America, with James P. Growdon in direct charge of all design and construction, and I. G. Calderwood as general superintendent of construction.

Rock Island Railroad Builds Direct Line to Kansas City

New construction, line revision and joint operation included in cutoff providing for faster and heavier trains—Special construction of large fills

AN UNUSUAL combination of new construction, line and grade revision, relocation and joint use of double track is found in the new 76-mile line of the Chicago, Rock Island & Pacific Railway, giving direct entrance into Kansas City, Mo. For the past 53 years the Rock Island trains from Chicago to Kansas City have been operated over the Chicago, Burlington & Quincy Railroad from Cameron Junction, Mo., to Kansas City, a distance of about 60 miles. However, the traffic agreement for this trackage expires in October, 1931.

Owing to the heavy Kansas City traffic of the Rock Island, the operation over this route, with a maximum grade of 1.4 per cent and heavy curvature, was expensive. An investigation as to the comparative economy of improving the old leased line or building a new line of its own led to the decision to build a direct connection from Coburn (92 miles from Kansas City) to Birmingham, Mo., a distance of 76 miles. By arrangement with the Chicago, Milwaukee, St. Paul & Pacific Railway, the latter joined in building a double-track line from Polo to Birmingham, 39 miles, each company to own its track but the two to be operated as a double-track line. Operating conditions on this new route will be much more favorable, as shown by the accompanying table, and it is expected to increase speed and reduce the time for both passenger and freight trains, while the latter will be of heavier tonnage. One of the principal bridges is shown in Fig. 1, with a map of the old and new lines in Fig. 2.

This new 76-mile cutoff may be divided into five sections: (1) a 37-mile single-track line built by the Rock Island from Coburn, Mo., on the main line, to Polo, Mo., where it connects with the Chicago-Kansas City line of the Chicago, Milwaukee, St. Paul & Pacific Railway; (2) from Polo west for 4 miles the Milwaukee road reduced its maximum grade from 0.75 to 0.5 per cent, and the Rock Island built a parallel track for northbound traffic on both roads; (3) from that point to Lawson, $7\frac{1}{2}$ miles, the Rock Island built a double-track line for

joint use of the two roads, and the old single track of the Milwaukee will be abandoned; (4) from Lawson to Moseby, 12 miles, the Rock Island built a single track on a different location from that of the Milwaukee, but the two single-track lines will be operated jointly as a double-track section; (5) from Moseby to Birmingham, Mo., 15½ miles, the Milwaukee road built a double-track line for joint use, and its old circuitous line will be abandoned. From Birmingham to Kansas City, 12 miles, the Rock Island will continue to use the Burlington single-track line. Thus for about 40 miles the Rock Island and the Milwaukee now have a joint double-track line into Kansas City.

All new construction work has been done by the Rock Island, except that the Milwaukee built the 15½ miles west of Moseby. Grading contracts were let early in 1930, requiring a total of 4,000,000 cu.yd. of excavation and fill, as the line is in very rugged and rolling country. The heaviest cut, 60 ft. deep and 5,000 ft. long, contains 345,000 cu.yd.; the largest fill is 65 ft. high and 8,800 ft. long, with 325,000 cu.yd. About half the fill material was from borrowpits.

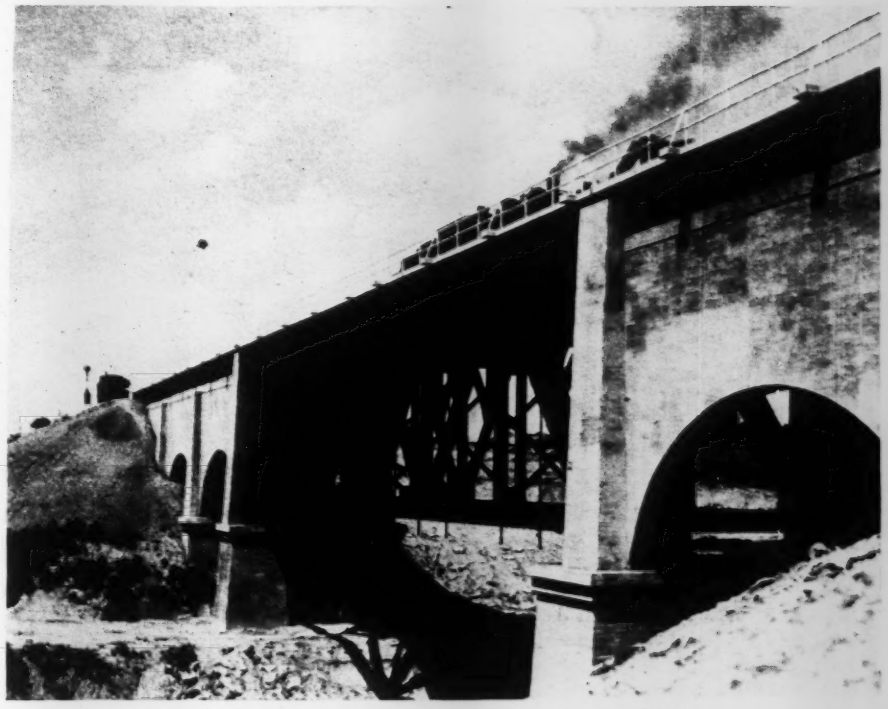


Fig. 1—Bridge over Crooked River on new Rock Island line

Double-track steel 150-ft. span with concrete-arch approaches carries ballasted deck.

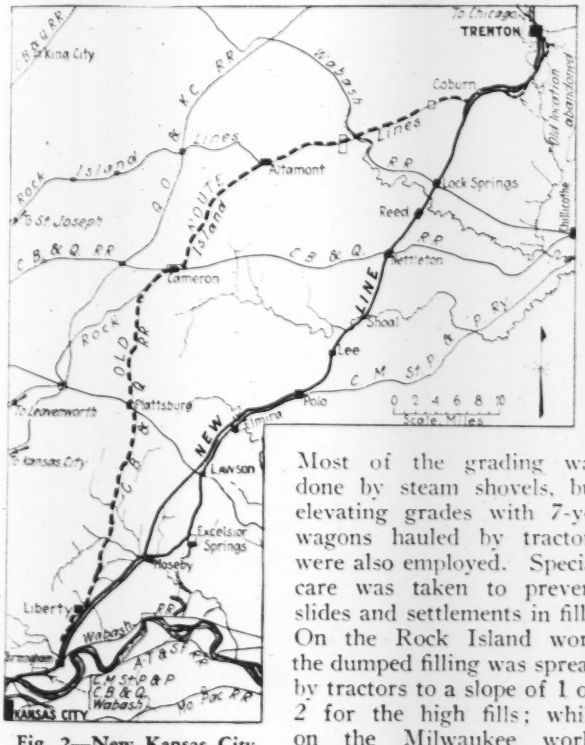


Fig. 2—New Kansas City connection, Rock Island Lines

Most of the grading was done by steam shovels, but elevating grades with 7-yd. wagons hauled by tractors were also employed. Special care was taken to prevent slides and settlements in fills. On the Rock Island work the dumped filling was spread by tractors to a slope of 1 on 2 for the high fills; while on the Milwaukee work, trestles were not used and the material placed by dump wagons was rolled in 12-in. layers by 10-ton rollers, the fills being given side slopes of 1 on 1½. Tile drainage is provided in the cuts.

The largest bridge is that over Crooked River (Fig. 1) near Elmira, Mo., with a 150-ft. double-track steel-deck span and concrete-arch approaches; the rail level is 84 ft. above water. There are a number of trestles, built of creosoted timber and having ballasted decks. A special feature is the avoidance of grade crossings of railways, highways and streets, there being only one such crossing of railways and 37 street and road crossings. Track was laid with 100- and 110-lb. rails of A.R.E.A. section, with treated ties and burned shale ballast 12 in. under ties.

COMPARISON OF OLD AND NEW ROUTES, TRENTON TO BIRMINGHAM, MO.

	Old Line	New Line	Differences
Distance, miles	91.55	82.92	8.63
Rise and fall, feet	3,113	1,860	1,253
Maximum grade, per cent	1.40	0.50	0.90
Number of curves	168	57	111
Total curvature, degrees	3,998	1,147	2,851
Sharpest curves, degrees	5½	1½	4
Double track, miles	None	47.3	47.3
Highway crossings at grade	101	37	64
Highway crossings by bridges	11	31	20
Railway crossings at grade	2	1	1
Railway crossings by bridges	1	3	2
Freight-train load, cars	50	105	55
Freight-train load, tons	2,100	4,500	2,400

The Rock Island work was planned and supervised by W. H. Petersen, chief engineer, with H. T. Livingston as engineer of construction and C. H. Gaylord as engineer in charge. The work of the Milwaukee road was under the direction of C. F. Loweth, chief engineer, and A. G. Holt, assistant chief engineer, with K. C. McFarland in direct charge of construction. The cost for the two roads was about $11,000,000 and $2,500,000, respectively, or a total of $13,500,000. Freight traffic was begun in July, and passenger traffic in September, 1931. For the old and new lines between Trenton (a division point) and Birmingham, Mo., the characteristics and differences are given in the accompanying table.

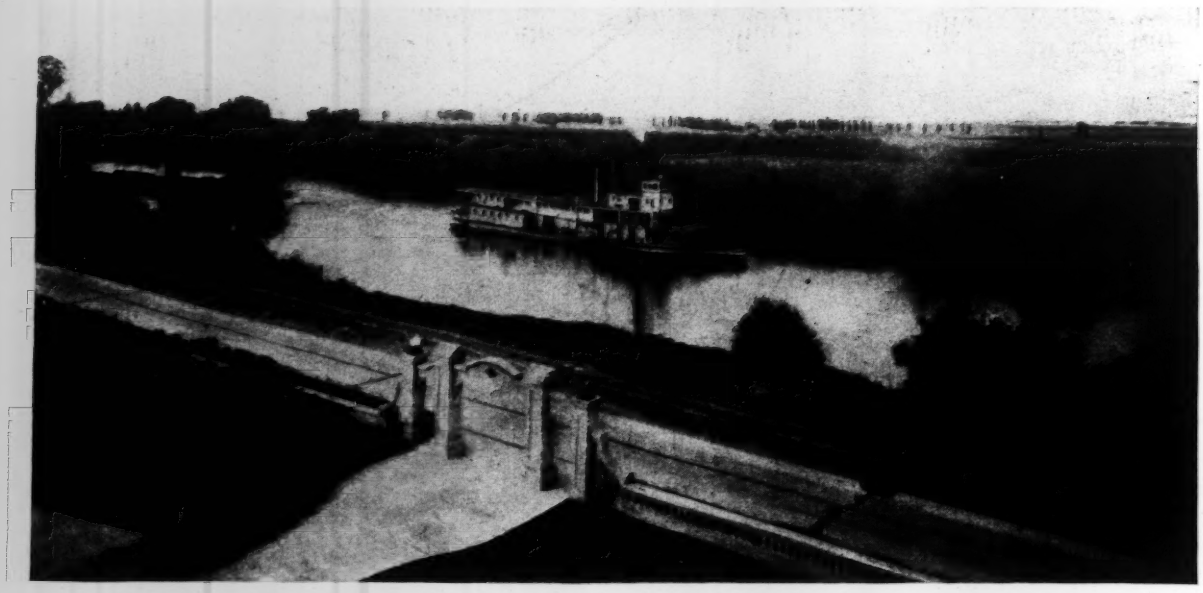


Fig. 1—This levee on Sacramento delta 20 miles below Sacramento has been intact since 1887, carries a paved highway 24 ft. wide and is protected by willow growth on the berm

Flood Control on Alluvial Rivers—II

Design and construction of flood-control structures on the Sacramento River, with particular reference to levee section, freeboard and protective covering

By FRED. H. TIBBETTS
Chief Engineer Sacramento River West Side Levee District, San Francisco, Calif.

THE FLOOD-CONTROL WORKS of the Sacramento River in California have cost to date about $100,000,000. This money has been spent mostly by private agencies and state reclamation districts guided in a general way in recent years by some measure of state and federal supervision. The bypass plan of flood control, proposed sixteen years before by Grunsky & Manson, was recommended in 1910 by Captain (now Brigadier General) Thomas H. Jackson, California Débris Commission, and it was adopted by the federal government in 1911 and by the state in 1913. The maximum flood discharge may exceed 600,000 sec.-ft. The control works are practically completed, have been tested by a moderate flood and in the opinion of California have solved the problem.

Levee Practice

Levees as high as 20 to 25 ft. are not uncommon. The cross-sections vary largely with the material available. The standard of the Sacramento River West Side Levee District has a 20-ft. top, a freeboard of from 6 to 8 ft. and side slopes of 1 on 2 on the rear side and 1 on 3 on the river side. Reclamation District No. 999 at the lower end of the largest flood basin, with a severe wave exposure and with levees up to 26 ft. high, has a 6-ft. top width, side slopes of 1 on 4 and 1 on 3, and a 4-ft. freeboard.

Suction dredges have been freely used for construction, with levee slopes varying with the material so as to get the most economical construction. Much of the material found can be readily placed with a suction dredge with slopes as steep as 1 on 3, but this requires such a large amount of hand labor that it is more economical to build flatter slopes, generally about 1 on 4 to 1 on 5.

Freeboard—The minimum freeboard is about 3 ft. This is desirable to protect the levee from being overtopped by waves caused by wind or passing steamers. The close prediction of maximum flood stages has been found to be impracticable. Even if the maximum flood flows could be accurately forecast, the maximum flood stages vary with the rapidity of rise of the river. During floods an alluvial river enlarges its channel, and the bottom and top surfaces of the flowing water get farther apart, the bottom going down and the top going up. The flood stage of the lower Sacramento, for example, with 200,000 to 500,000 sec.-ft. going down the valley, may be very materially different with the same volume of water on a rising than on a falling stage.

Fifteen years ago the writer fixed the standards of the Sacramento River West Side Levee District with an 8-ft. freeboard, above what was then considered as the "maximum probable flood." My clients and staff have been able to sleep during subsequent floods, but now the

top of our levee is only 3 to 4 ft. at certain places above the present estimate of "maximum probable" flood stages.

Top Width—Top widths vary from 6 to 20 ft. or more. In places the top width may be a function of the probable rate of advance of bank caving during a single season or single flood. Reclamation District No. 70 has sections of levee in which the recession of the river bank from bank caving has been generally uniform and at the rate of about 7 ft. per year. Here the use of a 20-ft. top width makes the levee wide enough so that bank caving cannot go through it during a single flood season. When a levee is finished it is a great advantage to have a highway (particularly a paved highway) on top, as it is then maintained at uniform height and is easily patrolled; also supplies in case of emergency can be rapidly assembled. This advantage is gradually fixing the top width of most of the river levees at from 20 to 24 ft. (Fig. 1).

Materials—Gravel and sand are very extensively used, particularly for the river levees. Such material alone would probably not be so suitable where flood stages are more prolonged, as on the Mississippi. It drains readily, however, and has the great advantage of immunity from the attacks of burrowing animals. The best levee sec-

Fig. 2—Trap-pipe discharge from 20-in. dredge used in constructing hydraulic-fill levee 22 ft. high with 1 on 3½ wide slopes at Collins Eddy cutoff

Fig. 3—Constructing setback levee at caving bank with clamshell dredge having 220-ft. boom and 5-yd. bucket

Fig. 4—Clamshell-dredge construction of a river levee near center of Colusa Basin

Front part clay and silt; rear part and bulk of section sand; volume 52 cu.yd. per linear foot; cost about 10½c. per cubic yard.

Fig. 5—Lumber revetment weighted with concrete blocks

About half placed under water after subaqueous bank grading with a dredge; built at Cecil Bend in 1922; average width 142 ft.; cost $24.20 per linear foot.

tions ever constructed at a seasonable cost which the writer has seen anywhere are combinations of earth and clay with suction-dredge-placed sand or gravel.

The river levees of Reclamation District No. 1,000 were constructed by using large draglines, excavating a centrally located trench and placing the earth and clay in side levees, particularly on the river side, then backfilling this trench by pumping sand and gravel from the river. The best levees of the West Side Levee District are earth levees of narrow cross-section widened at the rear and covered several feet deep on top and sides with suction-dredge-placed sand and gravel.

Location—Much of the levee system of the Sacramento River and main tributaries and even more of the bypass levees, or "back levees" as they are called in California, has been built by floating clamshell-dredge equipment. Even the largest machines cannot directly place material much more than 150 yd. from the point at which it is borrowed. Most of the river levees have accordingly been placed along the river banks with 25- to 75-ft. berms, so that they could be constructed with dredges that float in the river. Inside borrowpits or borrowpits for floating dredges parallel to the river and some distance away have also been used. The interruption of such borrowpits by traverses of undisturbed material, with the object of preventing a current from forming in the borrowpits, may be a great obstruction to the use of floating equipment, and in general has been found not only unnecessary but frequently undesirable. The inside borrowpits are much smaller channels than the river channels, and with a greater hydraulic radius and rougher sides they conduct floodwater with a velocity lower than that in the main river channels. They tend to silt up and in a few years are covered with vegetation and obliterated.

Through much of the upper Sacramento Valley the river has been wandering recently over a strip ½ to 1 mile wide, with numerous sweeping bends close together. The main levee lines are roughly parallel and tangent to the outer sweeps of the bends. Suction dredges have been largely used in this section for building the levees across the cutoffs. The bends are usually heavily timbered; hence placing the levees as cutoffs does not result in cutting off or shortening the river channel (Fig. 2).

Equipment—All sorts of equipment have been used, and in recent years there has been a tendency toward a growing use of large and mobile dragline equipment. The bulk of the levees in California, however, have been built with floating machinery, either with suction or clamshell dredges, Figs. 3 and 4. (See article by the writer on large clamshell dredges, *Engineering News*, Sept. 4, 1913, p. 456.) Machines of this type can now place material about 150 yd. from the point of borrow. Building the rear slope of the levee of wet material enables it to be slid into place successfully still farther. Dropping heavy masses of wet material with these machines tends to compact the levees in much the same way that concrete is compacted by placing with aerial chutes. Where the specifications allow the use of this type of machinery, large volumes of material can be placed very cheaply and rapidly. These machines are heavy and require 6 to 8 ft. of water for flotation and cost as much as $300,000 each. Auxiliary operations on a considerable scale are frequently required to supply water for flotation.

Protective Covering—Levees should be protected in the order of importance from (1) burrowing animals,

Fig. 6—Obsolete type of log jetty

Fig. 7—Current retards of loose logs and brush

(2) current erosion, (3) wave erosion, (4) rain erosion and (5) wind erosion.

Sodding is not much used in California because of the difficulty of keeping grass alive during the arid summers, although bermuda grass or similar grasses have been used occasionally on sand levees.

A gravel covering furnishes the best protection against all classes of erosion and frequently can be economically placed with a suction dredge. The use of crude oil in the surface layers of sand levees placed under pressure and at a high temperature has not proved successful. Concrete or asphaltic pavement has been extensively used and protects the levee tops perfectly. For protection from wave wash, particularly from wind waves on the back levees and steamer waves on the river levees, the growth of willows has been extensively encouraged on the levee berms. For severe exposure to wind waves much better protection is afforded if the willows are

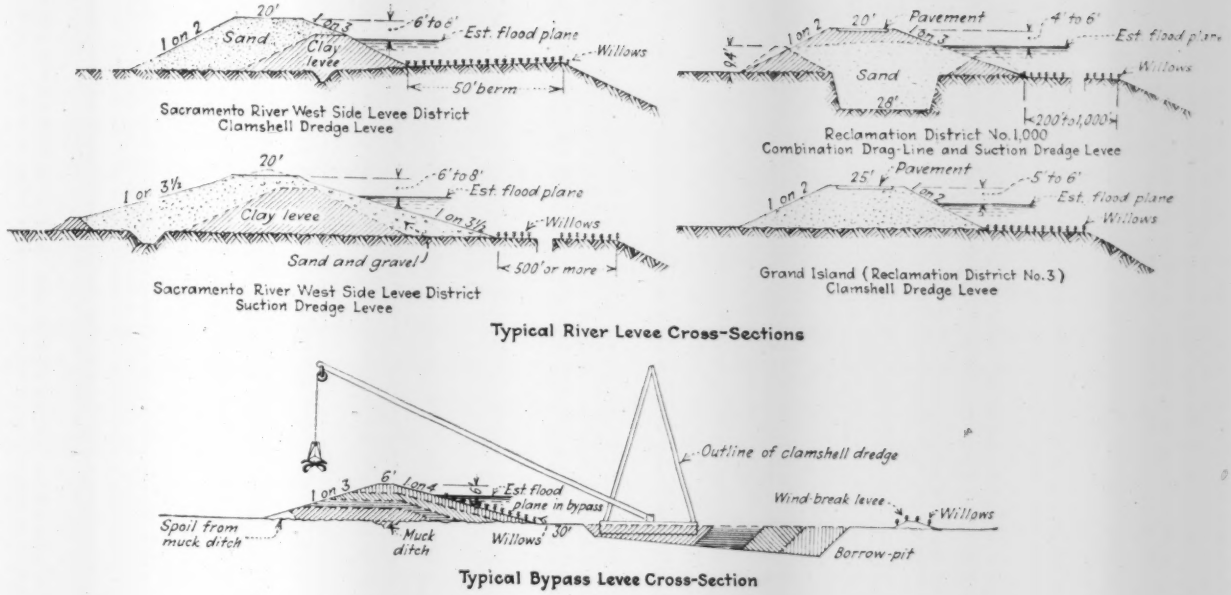


Fig. 8—Types of levees for Sacramento River flood control

100 yd. or so distant from the slope to be protected, and breakwater mounds planted to willows are used for this purpose.

Revetment

As urban or agriculture developments concentrate along the river banks, bank stabilization becomes of great importance. Articulated concrete-block revetment has been extensively used at important points. Lighter and much cheaper lumber mattresses (Fig. 5) have been used successfully, but they are subject to serious injuries from steamers and particularly barges in tow. Brush mattresses have been used but little.

Where levees are to be protected in this way, the top widths are narrowed and the protected slopes are steepened to reduce the area of revetment. Mattress work is generally intended to reach out below the river bottom to the thread of the current. Subaqueous grading of the under-water extension is readily and cheaply performed with floating dredge equipment, particularly with clamshell dredges.

Retards

To protect river levees from steamer wash, piles driven 10 to 20 ft. apart, parallel to the river bank, bound together with cables and occasionally supporting loose brush, have been used without much success.

Log jetties, with logs normal to the bank and current, anchored to the bed of the river with screw piles and to the bank with cables and deadmen, were tried out on a considerable scale a few years ago. The structures were built of solid logs, were 20 or 30 ft. wide and projected out from the bank 30 to 70 ft. They were wrong in principle. The interruption to the current tended to create disturbances immediately below, which accelerated rather than decreased the bank caving, which they were designed to check. They were soon abandoned (Fig. 6).

Open brush and log retards are now extensively used and are quite successful. These consist of mats of full-size trees placed parallel to the bank with butts upstream and built out from the river bank above the reach of active bank attack. When properly installed these structures present only partial obstruction to the river current, allowing floodwaters to go through without much surface disturbance and checking the velocity downstream from the retards sufficiently to promote the rapid formation of silt deposits, which blanket and support the caving banks. This type of revetment is most promising and will probably be extensively used in the future (Fig. 7).

Spillway Types and Structures

Four concrete spillways have been constructed at points of flood diversion from the main river. The first one of these, the Elkhorn Weir, was built by the state in 1905. It was a concrete sill, at bank height, about 2,000 ft. long. The flood basin in front was not kept clear; sand and silt were drawn up over the weir at flood stages, and in a few years the weir buried itself and was no longer operative. The design, or at least the operation, was faulty. It is much better in principle to have such a structure with movable and controlled crest such as the Bonnet Carré spillway, at New Orleans, and the Sacramento spillway.

Spillways should be operated only when necessary, drawing off as little of the top water as may be required to hold the floods down to heights that can be passed safely by the levee systems. The bypasses in front of the weirs must be kept clear, in order that the water drawn out from the main river may be passed on as rapidly and with as little silt deposition as possible.

Japanese Subway Opened

In April of this year a subway, 1½ miles long and linking Seiin and Keihan (Kyoto, Japan), was opened as part of the Shin Keihan interurban line between Osaka and Kyoto. The subway was built to enable the interurban railroad to enter Kyoto, and plans have been approved for an extension to Sanjo (Kyoto), which, if carried out, will make a complete subway almost entirely across the city.

Sealing Bridge Cofferdams by Grouting

Boulders in gravel obstruct sheetpiles—Grout pumped through pipes outside the sheeting consolidates the material

By E. O. GOLDSTEIN
Assistant Resident Engineer, Arkansas State Highway Commission

GROUT INJECTION successfully sealed the ledge covering of gravel and boulders, through which steel sheeting could not be driven, in building the piers of the new highway bridge across the Arkansas River at Ozark, Ark. Cofferdams were planned for the main river piers of the six arch spans. Work was begun on the channel pier, since the rock was deepest here and it was desired to take advantage of the low-water stage. Work on the other piers followed closely. As the operations were all similar, only those at the channel pier are described.

Steel sheeting was driven with extreme difficulty to what was thought to be bedrock, but an attempt to unwater the inclosure showed that the difficulty in driving was due to a massed boulder formation overlying

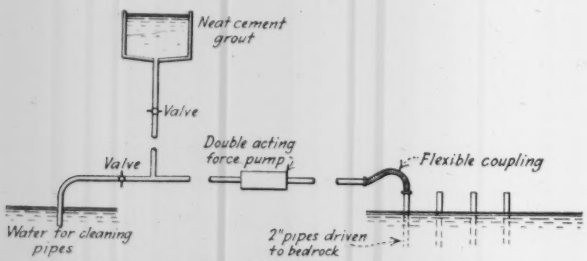


Fig. 1—Equipment for grouting cofferdam

sound rock. With two 8-in. and two 6-in. centrifugal pumps it was impossible to unwater a cofferdam 40x32 ft. The formation was a mixture of sand, coarse gravel and boulders of very hard rock ranging in size up to 10-ton pieces.

An attempt to seal a cofferdam of this type by driving a second and outer ring of piling would have been a costly process, with no certainty of success. At the suggestion of the state highway engineers it was undertaken to seal the cofferdams with neat cement grout. After the sheetpiling had been driven and jetted to refusal, a line of 2-in. pipes at 3-ft. intervals was driven around the dam and about 1 ft. from the outside of the sheeting. The pipes average about 35 ft. in length. Extreme care was taken to make sure that no pipe had split in driving. When each pipe had been driven to refusal, it was cleaned out with a jet and chopping bit. Grouting operations were begun after all the pipes had been driven and cleaned.

The operation is indicated in Fig. 1. Grout was mixed in an open 4x12-ft. tank, using about 5 gal. of water to each sack of cement. Passing the grout back and forth through a double-acting force pump insured thorough mixing but caused great wear on the valves and subsequent loss of time for repairs, so that it was soon abandoned for hand mixing. A quantity of grout containing three sacks of cement was pumped into each pipe, this

Fig. 2—Grouted conglomerate

quantity being ascertained by a gage on the side of the tank, graduated to read in sacks of cement. It required a pressure of about 100 lb. to start the grout through the pipe, after which it required only about half that pressure. When a rather low pressure started the grout through the pipe, the quantity used was increased. In some cases as much as eight sacks were pumped into one pipe. The speed of the double-acting steam force pump was a good indication of the pressure required. Near the close of the pumping operation the pipe was slowly lifted from the rock. A Y-branch connecting the suction of the force pump to the river enabled each pipe to be thoroughly cleaned for use again by opening the river branch.

Each cofferdam required about 300 sacks of cement for a complete seal. The results were very satisfactory. In four to six days after grouting the cofferdams were easily unwatered. The cement permeated and filled all the crevices in the boulder conglomerate. In one case the sheetpiling was stopped 6 ft. above bedrock, and the water was restrained only by the cemented conglomerate. Fig. 2 shows a mass of this material removed in excavating the foundation.

Before proceeding with the rock excavation it was decided to remove all boulders holding piles above the bedrock. In some cases it was necessary to use dynamite, but no serious leakage resulted. When these boulders were removed, the piles were driven the additional distance to rock. In two cases, with a head of 42 ft. of water, one 6-in. centrifugal pump running at half capacity enabled all the foundation concrete to be placed in the dry.

The contractor was M. E. Gillioz, Monett, Mo., and the work was under the direction of James Kratoska, superintendent, and H. W. Carpenter, engineer. The design and construction were under the direction of the Arkansas state highway commission, N. B. Garver, bridge engineer. S. C. Waller was resident engineer and was assisted by L. A. McCain and the writer.

Concrete Blocks Supplant Ties

Concrete-block track construction in use on the electric interurban line of the Pittsburgh, Harmony, Butler & New Castle Railway is somewhat similar to the Italian design described in *Engineering News-Record* of March 28, 1931, p. 514. For the American track, however, the blocks are cross-shaped in plan, the 63x16-in. longitudinal portion that carries the rail being supplemented by 20-in. wings 12 to 16 in. wide. These blocks are spaced about 6 ft. 9 in. c. to c. The thickness is 8 in. for the longitudinal portion and 7 in. for the wings, all being flush at the bottom. Steel tiebars are welded to the rail flanges at intervals to maintain the gage and also serve as transverse electric bonds. In the top of the block is a $\frac{3}{4}$-in. recess or panel 5x55 in., in which are placed two $\frac{1}{2}$-in. sheets of packing upon which the rail rests. Near each end of the block the rail is fastened by a pair of clips on special bolts, which enter cored holes and engage metal lugs embedded in the concrete.

Missouri Tornado Damages Three University Buildings

By E. J. McCAUSTLAND
Dean, College of Engineering, University of Missouri, Columbia

ON SEPT. 21, 1931, a small tornado damaged three of the University of Missouri buildings. There is apparently nothing unusual in the effects except that the tornado happened to strike a group of buildings in a way to do considerable damage not immediately obvious. Apparently this was due to the marked twisting effect of the tornado in its path and the fact that it happened to strike places that would yield rather easily to this type of force.

At 7 p.m. a "thunderstorm squall" affected a local area about 1,000 ft. wide and possibly 2 miles long. No further damage was done in the track of this storm on its northeasterly course for a distance of 10 miles, where, however, it again descended to the earth's surface and destroyed a group of farm buildings, completely scattered several stacks of hay and killed a horse. Beyond this point no reports of damage have been received.

The campus of the University of Missouri happened to lie exactly in the center of the apparent width of

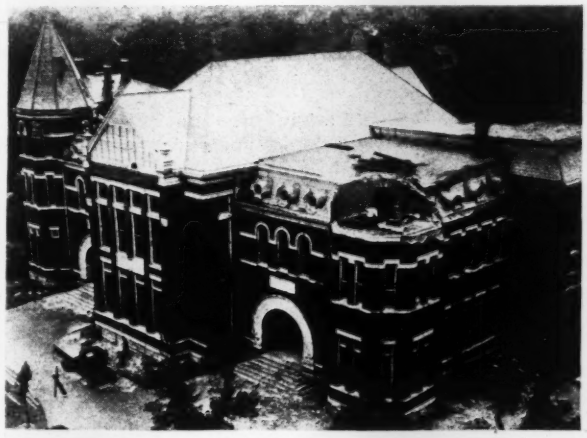


Fig. 1—Twisting action of tornado removed one corner tower and severely damaged a second on geology building

the storm area and about 500 ft. from the point where the twister, coming from the southwest, first showed any indications of its presence.

George Reeder, meteorologist in charge of the Columbia station of the U. S. Weather Bureau, states that this was a typical tornado preceded by definite cyclonic conditions in the atmosphere. Its period of activity as registered at the local station was not more than 5 min. During this time the temperature fell 22 deg., and the humidity was increased about 25 per cent. For 1 min. the velocity of the wind was 64 miles per hour, and this period was followed by about 4 min. of a 45-mile gale, after which the storm gradually subsided.

Only three buildings on the campus were damaged. The most serious single item was the complete twisting off of one corner tower of Swallow Hall, occupied by the geological department (Fig. 1). The opposite tower on the same building shows the effect of a twisting action that loosened much of the face brick and cracked the wall in several places. The cracking of the wall and the internal damage under the removed tower exposed large collections of geological specimens to damage by rain.

A large building near by, having a tower at least 200 ft. high, was undamaged except for the removal of large areas of metal roofing and cornice, which were torn away and carried 300 ft. On its flight this metal struck the roof of the Law Building and sheared off a considerable area of slate roofing, but did little other serious damage.

Fig. 2—Storm removed a finial and its support from top of this structure but did not disturb loose lumber on ground at the base

Fig. 2 indicates what seems to me to be the most interesting fact in connection with this storm—removal of a finial and its support from the Memorial Tower, not disturbing in any way pieces of lumber and other rubbish lying along the base of the tower.

The secretary's office estimates the cost of repairing these buildings and replacing the damaged material at about $10,000. It is further estimated that there was a damage of at least $1,000 in the breaking of trees and shrubs on the campus.

This tornado was of a type not unknown in Missouri, although there is no increase in their frequency, as indicated by the records of several decades. In the decade 1887-96 there were four, which is also the average of the 50-year period 1877-1927. There has, however, been an increase in the damage done, due to the more thickly settled country. In all cases the general direction of the movement of the storm in the same; these tornadoes originate somewhere in the West or Southwest and move toward the East or Northeast. The local weather bureau is responsible for the opinion that in an average year in this region the chance of a person being killed by a tornado is 1 to 200,000, and about 1 to 36,360 of being injured. The meteorologist of the station says: "We might better express this ratio comparatively by saying thit if every person in Missouri were due to live 70 years without a tornado, life would be shorter by 8½ days because of tornado hazard." In the storm that forms the subject of this note, there were no persons injured, so far as the writer knows.

Long Pontoon Bridge Built in Africa

A floating toll bridge 1,300 ft. long and supported on 128 pontoons fixed by 32 anchors, was opened recently at Mombasa, the chief port of British East Africa (Kenya). The bridge, known as the Nyali bridge, connects Mombasa Island with the mainland, and is intended to open up the mainland for residential purposes. The bridge is privately owned. Connection between the island and the mainland heretofore has been by a railway causeway.

Fig. 1—Scrip labor built this large swimming pool in a Grand Rapids public park

Grand Rapids Unemployment Relief Plan Gives Civic Improvements in Return

Scrip-paid labor removes eyesores, provides recreational facilities and extends municipal utilities—Food and clothing exchanged for scrip at city-operated stores

THE POLICY of relieving unemployment distress by expanding public-improvement work has received general approval, but carrying the policy into execution has been delayed in many places by the difficulties involved in developing a smoothly functioning administration. After two years of experience in working out a rational relief program Grand Rapids has evolved the administrative machinery described in the following report. The plan is focused primarily on social welfare rather than on a program of public-works construction with employment benefits as a comforting sequel. Within the limitations of the available funds the plan is working admirably.

—EDITOR.

UNEMPLOYMENT RELIEF in Grand Rapids, Mich., is being administered by a scrip-labor plan. Applicants for relief are employed by the city at 40c. per hour on various public-improvement projects, and the method of payment for the work done is such as to assure that the real necessities of life are provided, while still allowing a choice in the articles received. The men are paid in scrip certificates, which are not transferrable and can be used for purchase only at a store operated by the city where food, clothing and household supplies are sold. The number of hours of work assigned to each applicant is determined by the size of his family and the urgency of his needs, and the nature of the work is governed by the recommendation of a medical examiner. Only in those cases where there is no breadwinner or where the poor health of the applicant precludes his employment in this manner is free relief given. The plan has been in operation for two years, and at the beginning of September there were 1,870 men on the scrip payroll. Public improvements carried out are of the type that require a minimum of materials and equipment and a great amount of labor. All the city departments cooperate with the social welfare department in providing work projects, and the various jobs are coordinated by a member of the city engineer's staff.

The scrip-labor plan is financed by a bond issue of $650,000. The city charter allows the council to issue bonds to provide for relief of the citizens in times of calamity or catastrophe to a sum not exceeding ¼ per cent of the total assessed valuation. Based on the 1929 valuation this sum would be $686,000, but the decrease in property values during the past year has reduced the basic figure so that the $650,000 represents the limit of indebtedness for this purpose. During the past summer $100,000 worth of the bonds were retired from taxes. This sum can be reissued, and it will probably be before the end of the year. At the end of September there still remained a balance of about $100,000 in the funds of the social welfare department.

Those in need of relief make application to the welfare department. It is made clear that they are not applying for jobs but for relief from their distress. Immediately following their filing of application they are interviewed by the welfare department's workers, and their homes are visited. In this way information is obtained as to the length of residence in Grand Rapids, the number of dependents, the general economic status and the occupational history of the client. The degree of destitution required before granting relief is not fixed but is set in individual cases in the light of other factors. An elderly man, for example, is not required to cash in an insurance policy before being given aid, because he would find it extremely difficult to be reinsured at a reasonable cost. Likewise an equity in a home does not necessarily make him ineligible for assistance by the welfare department.

On the findings of the department's visitors a recommendation is made as to the number of half-days of

Application for Material Relief

STATE OF MICHIGAN, } ss.
County of Kent }

I, _____, living at _____
(Give full name)
_____, for the purpose of obtaining material relief from the Welfare Department of the City of Grand Rapids, represent under oath as follows:

That I am a resident of the City of Grand Rapids, and have resided within the limits of said City continuously for more than one year prior to the date of this application; to-wit, since the _____ day of _____, 19____.

That I am (married) (single).

That my dependents and their relationship to me are as follows: _____

That I am not now employed in a gainful occupation, except as follows: _____

That I own no property, nor do I have an interest in any property, real, personal or mixed, except as follows: _____

That I have no cash on hand or in any bank, except as follows: _____

That I have no income from any source, except as follows: _____

That no person owes me money nor do I possess any bonds, notes, promises of payment, stocks, etc., except as follows: _____

That I have no life insurance, or sickness or accident insurance, except as follows: _____

That my dependents have no property or income, except as follows: _____

That I rent property as follows: _____
from _____ paying $_____ per (month) (week).

That I owe debts as follows: _____

That I am not now obtaining material relief from any other organization or person, except as follows: _____

That, if I am granted material relief by the City of Grand Rapids, I shall, while receiving such relief, immediately inform the Director of Social Service of any change in my condition or of that of my dependents, and especially will I give information when I or any of my dependents obtain (a) Material relief from any other organization or person; (b) Employment of any kind or nature; (c) Property of any kind or nature; (d) Income from any source whatsoever; and I understand that failure to give such information shall constitute a material misrepresentation on my part.

Subscribed and sworn to before me, this _____

_____ day of _____, 19____. _____

_____ Witness _____

Notary Public, Kent County, Mich.

My commission expires _____ Witness _____

Fig. 2—The "client" first of all fills out this application for relief

work to be assigned the client. He is also examined by the city physician, who gives special attention to disabling conditions, such as hernia or tuberculosis, and who recommends regular work, light work or no work. The client who is physically able is then given an identification card and a work slip bearing the department's recommendation, and he reports to the city employment office. Twice a week the welfare department makes out a list of assignments to be sent to the employment office, on which are noted the changes to be made in the work list. When a client is successful in finding another position his name is removed from the work list, or if his distress becomes more severe the work hours assigned him are increased.

The public-improvement projects adaptable to scrip-labor work are reported by the various city departments to the employment office. One man, who for some years had been a field engineer in the city engineer's department, has been assigned the sole task of discovering work of a suitable nature that can be done for the city and coordinating with it the supply of labor made available by the welfare department. His engineering knowledge is indispensable for this task, enabling him to recognize those tasks for which a minimum of equipment and materials and a maximum of labor will be required. The men reporting to the employment office are then assigned to definite projects, where they work under the supervision of foremen in the regular employ of the departments under whose jurisdiction the work comes. In all cases four hours constitute a working day.

Time records are kept by the foremen, who forward their time reports regularly to the comptroller's office. Payrolls are made up as under ordinary conditions, and each department has a book charge made against it for the benefits it has received. Instead of money being sent with the payroll to the paymaster, however, enough scrip certificates to balance the payroll are sent to the employment office. Here the scrip laborers are paid off. Scrip coupons come in two denominations, $1 and 20c.

Food, clothing and household supplies can be purchased with scrip at a store operated by the city. Groceries tobacco, flour, vegetables, meats, dry goods, shoes, shirts and other articles of clothing are sold there at prices somewhat under those charged by the regular retail stores. Goods are bought through the city purchasing agent, frequently in carload lots, and only the overhead cost of store operation is added in determining the selling price. The purchaser must present the scrip-labor identification card to have the scrip coupons honored. No change is made at the store, purchases having to be made in multiples of twenty cents. As a result, money is not used at all.

The fire and police department stations have been pressed into service to distribute the perishable commodities, like bread and milk. To purchase these the regular scrip coupons must be exchanged for special tickets. Orders for fuel are made out by the workers at the employment office, and the price of his purchase is charged to his payroll account. A record of purchases of these items is kept to guard against

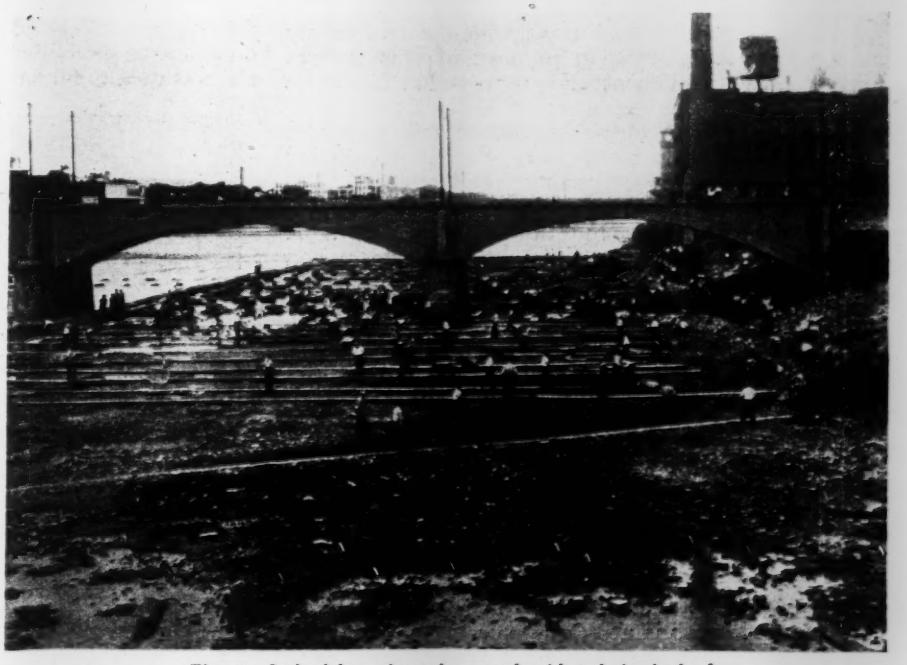


Fig. 3—Scrip labor cleaned up and widened the bed of Grand River to improve its appearance at low water

CITY OF GRAND RAPIDS

Dear Sir:

Please report at once to 16 Campau Ave. for work assignment.

Jack Huban

A—Men do not wait around employment office for work assignments but are notified to report by postcard notices mailed to their homes.

NUMBER ✓

CITY WORK ASSIGNMENT

Name ✓

Address ✓

Assigned to Wabash St. Sewer

Date 9-25-31 Per

Three half days

SOCIAL SERVICE DEPT.

FOREMAN WILL RETAIN THIS CARD AND RECORD NUMBER ON TIME BOOK AND PAY ROLL

B—After reporting for assignment the client carries th card to foreman on job designated. Reverse side of car carries worker's signed promise to accept payment in scrip.

No 5827

IDENTIFICATION CARD

Name _____

Address _____

Age _____ **Status** _____ **Children** _____

Remarks _____

CITY SOCIAL SERVICE,
Guy Northrup, Director.

C—Scrip worker must present this identification card when purchasing supplies at the city store.

NAME _____ NO. _____

ADDRESS _____

DATE	Code	Groceries	Scrip Pay Roll	Cash Pay Roll	Clothes	Fuel	Rent	Medical

D—This record of relief given to each worker reveals any disproportion in type of assistance that he receives.

Fig. 4—Typical forms used in administering Grand Rapids' scrip-labor relief plan

disproportionate purchasing of commodities and their subsequent sale by the client. Each step of the relief administration is designed to assure that the funds available for relief are directed to legitimate relief measures and to prevent the indigent from turning the goods supplied them into money.

Arrangements have been made with the local utility companies to accept scrip in payment of bills for gas and electricity, the coupons being redeemed at face value by the city.

The public improvements handled in this way have varied in magnitude from a river-widening job, costing $58,000, to minor items, costing less than $10. The river widening was undertaken to improve the appearance of the river bottom at times of low water. It consisted of cleaning away deposits of boulders and large gravel and removing shallow islands harboring groups of willows. The gravel and stone removed was utilized to construct a riprap wall along the river bank, bringing about a marked improvement in appearance. To facilitate the work, a timber bulkhead was built out in the river, allowing a large area of the riverbed to be worked on in the dry.

Another job was done for the water department in extending a 30-in. reinforced-concrete-pipe sludge drain from the sedimentation basins. The drain had formerly discharged its contents right at the river's edge, and a large area had been covered with a deposit of the lime sludge resulting from the softening treatment. By extending the line so as to discharge in the middle of the river, deposition is now prevented by the river current. In this case the materials of construction were supplied by the water department.

A surprising number of jobs were found, which had long been contemplated by the various city departments but whose execution had been delayed by lack of funds for the specific purpose. The park department utilized scrip labor in building a large reinforced-concrete swimming pool in a public park. An unpaved street, several feet higher than the grade of the sidewalks, was brought down to the established grade, and the excavated material was used to fill an adjoining low section. A marshy

Fig. 5—Boulders removed from the river bottom were used to riprap the banks

area was transformed into a small lake by building an earth dike around the spring from which the water came. The banks of a small creek were smoothly graded and trimmed. An old building belonging to the city was razed and its materials salvaged to make the site available for a proposed civic auditorium. The salvage work involved in this job served admirably to provide light work for those incapable of hard labor.

In the later months of its operation a complete accounting of the system has been kept. During the month of August, 1931, the figures show that $41,677 was expended for relief by means of scrip labor. In addition, $5,275 was used for free relief, those cases where there was no able-bodied breadwinner. At the end of that month there were 2,072 men on the work list. During the week ending Sept. 5 the scrip payroll was $10,473, with 1,870 men on the payroll. The average weekly wage received was $5.70. In the period from April 1 to Sept. 9, 1931, the total amount paid out for scrip relief amounted to $229,450. The total expenses of

Fig. 6—Indian Mill Creek was changed from an eyesore to a beauty spot by cleaning it of obstructions and trimming and grading its banks

the welfare department for the period, including free relief and administrative costs, were $311,680.

Single men without dependents are not eligible for scrip work in Grand Rapids. They are supplied food and shelter at a social center, an old church building that has been turned into a combined dormitory and mess hall. Each man, however, is required to perform three half-days of work each week, for which he receives only his subsistence.

It is planned to absorb many of those now on the welfare department's work list on the public-works contracts to be let in the near future. The proposed civic auditorium, to cost $1,000,000, will be ready for contract before December. The city engineer's department has recently let an $85,000 contract for the construction of 3,000 ft. of 10-ft. reinforced-concrete sewer. The contractor has agreed to use a maximum of 25 men of his own organization and to obtain the rest of his labor from the welfare department. In a few months some extensive street widening is to be undertaken, which will bear a total cost of $1,667,000. Of that amount $667,000 will be spent on acquiring the right-of-way. However, much of that sum will be re-expended on construction, as it represents the cost of existing dwellings that will have to be torn down and that will probably be replaced at some other location.

Electric-Resistance Strain Gage Measures Stresses in Concrete

Device embedded in mass concrete records stress to 10 lb. per sq.in.—Principle based on resistance of wire under tension

By E. C. EATON
Chief Engineer, Los Angeles County Flood Control District, Los Angeles, Calif.

STRESS MEASUREMENT within mass concrete can be determined in units as small as 10 lb. per sq.in. by an electric-resistance strain gage recently developed in the testing laboratory of the Los Angeles County Flood Control District. The work has been carried out under the direct charge of R. W. Carlson, testing engineer, and the device was used for the first time in actual practice in the Big Tujunga arch dam recently completed for the district. Embedded in laboratory test specimens, the new gage has indicated results agreeing almost exactly with those obtained by the ordinary mechanical type of gages applied to the surface of the cylinder.

The principle of this gage is based on the change in electrical resistance of an elastic steel wire due to change in tension of the wire. The term "elastic" is used because in the gage the wire operates within a small part of its elastic range and therefore obeys Hooke's law within very minute limits. The breaking strength of the wire used is approximately 700,000 lb. per sq. in., and a conservative figure for elastic limit is 300,000 lb. This steel wire has a percentage change of resistance, due to change in tension, of roughly four times the percentage length change that results from that tension. Also, it has a change of resistance due to change of temperature amounting to 0.35 of 1 per cent per degree C. These characteristics enable field measurements to be made with a gage that yields observations of strains to 0.000,003 in. per inch, or approximately 10 lb. per sq. in., and temperature change to $\frac{1}{4}$ of 1 deg. C.

Construction of the gage and arrangement of the wire coils are clearly shown in Fig. 2. After winding in the grooves, each coil of wire is placed under an initial tension. This tension is secured by suspending a weight from the end of the wire and bringing the tension in each half turn of the wire up to this equivalent strain. After the initial tension has been obtained the wires are

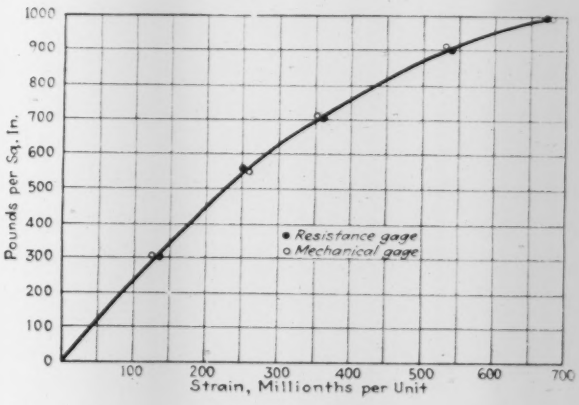


Fig. 1—Comparison of strain measurements made by electric resistance and mechanical gages embedded in concrete test cylinder

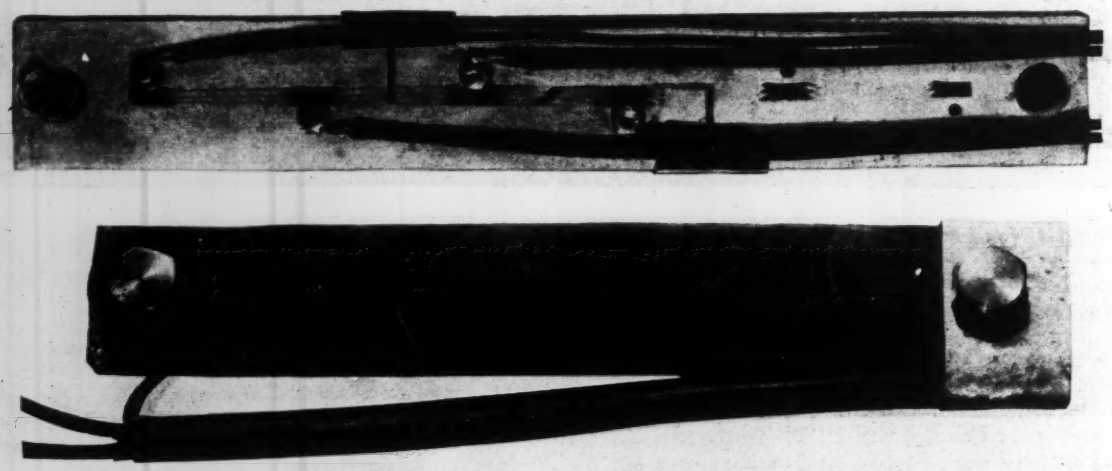


Fig. 2—Two views of electric strain gage assembled and covered ready for embedding in concrete

Framework of two unglazed porcelain plates ⅜x1⅜ in. (upper) provides grooves for three coils of steel wire. Arrangement provides a coil unaffected by movement in the gage and two affected in opposite manner. Metal sleeves maintain alignment permitting only longitudinal motion. Copper wires from each coil lead to central switchboard. After assembling, gage is encased in rubber cover (lower), which is filled with glycerine and closed by a clamp and cable joint compound to assure against leakage. The gage is then ready for placing in the concrete.

clamped and carefully soldered to brass screws passing through the porcelain frame. This method of fastening the ends has proved satisfactory and is an extremely important feature in measuring changes in length as small as 0.00002 or 0.00003 in.

A Wheatstone bridge-wiring diagram is used in measuring resistances. The ratios are measured rather than actual resistance in the determination of a strain to eliminate the direct effect of temperature on the resistance of the coils and, further, to reduce the errors of lead-wire resistance. Because the change in resistance of the steel wire is directly proportioned to the change in tension, it is unnecessary to calibrate each gage separately.

The arrangement of the coils, providing one unaffected by movement in the gage and two affected oppositely, permits checking the operation of the gage. Obviously, one of the strained coils checked against the neutral coil should show a resistance change equal but opposite to the other.

Resistance ratios are measured without difficulty to 0.01 of 1 per cent. If the temperature difference between two of the steel wire systems is more than one-twentieth of one degree, the error is more than the least reading. However, the wire systems are placed close together, and the small difference in temperature that does occur is reduced to an insignificant figure by copper heat conductors laid alongside the steel wires. The copper conducts heat several hundred times as well as porcelain or concrete, so it is quite efficient in reducing temperature gradients.

Since the accuracy of resistance measurement is greater than the accuracy of resistance coils that are readily obtainable, only a small portion of the resistance of the adjustable arm of the Wheatstone bridge is made variable. The larger portion of this arm of the bridge and all of the other arm in the testing set is buried in paraffine and is not disturbed. Thus, with resistance coils of accuracy 0.1 of 1 per cent, changes in resistance or resistance ratio can be measured to 0.01 of 1 per cent, or better, without difficulty.

Translating Resistance to Strain—After a gage is embedded in concrete and the material has set, measurements can be taken. The procedure consists of measuring the ratio of resistance between the coil unaffected by movement of the gage and the other two coils. Also the actual resistance of the former coil is measured. Calibration trials are made to determine the change in strain, which corresponds to a known change in resistance ratio.

The temperatures are obtained from the resistance of the temperature coil and from the fact that the resistance changes 0.35 per cent per degree C. The resistance at a known temperature is determined before the gage is placed in the concrete.

Change in resistance ratio between the coils is directly proportional to the strain, and the amount of change for a given strain is the same for all gages of the same design. The measurement automatically corrects for change in temperature of the wires and its effect on resistance, although there is, in addition, a small correction for expansion of the steel wire and porcelain frame due to temperature.

To provide a check for the results to be obtained by the resistance strain gage, the device was placed in a test specimen and placed under actual load. The results of such a test were calibrated against an ordinary mechanical gage. Results were most satisfactory, the two devices giving practically similar measurements. An example of the results obtained is shown in **Fig. 1.**

Reducing Water Loss in Track Tanks

Track-tank water-waste due to spillage and spray while locomotives of fast trains are taking water may be reduced materially by a curved deflector plate about 16 in. in front of the water scoop, according to tests on the London, Midland & Scottish Railway (England). With this deflector the water is moved away from the sides of the trough or track tank, thus increasing its height in the middle, while ordinarily the scoop displaces the water so that it spills over the sides of the trough. In these tests the effect was to increase the amount of water delivered to the tender by nearly 20 per cent and to reduce the corresponding loss or waste by about 50 per cent, as well as reducing the objectionable splashing.

Simple Patching Method for Smoothing Macadam

Skillful patching produces remarkably smooth surfaces on macadam roads roughened by long service

By J. R. McDERMOTT
District Engineer, State Road Commission, Keyser, W. Va.

MANY miles of earlier-constructed macadam highways are of adequate strength for the traffic they have to carry, but are of such waviness and roughness of surface that the motoring public properly adjudges them adversely by comparison with recent construction under a more exacting technique. Complete resurfacing with a bituminous retread top course is a frequently satisfactory remedy, but lack of funds often precludes entire resurfacing, yet some economical method of eliminating much of the unsatisfactory riding qualities must be employed. In such cases we have frequently used in the eastern section of West Virginia a poured patching method that may be called retread patching.

Macadam projects are stocked during the late winter months with approximately 50 tons of limestone chips per mile, neatly piled on the right-of-way at intervals of not over half a mile between stockpiles. Of this stone about one-third is small-size chips ranging from $\frac{5}{8}$-in. to $\frac{1}{8}$ in. and two-thirds is coarser chips from $1\frac{1}{4}$ in. to $\frac{3}{4}$ in. Occasionally we have used $\frac{3}{8}$-in. to 10-mesh crushed stone chips or a very coarse sand instead of the $\frac{5}{8}$-in. to $\frac{1}{8}$-in. stone chips. The coarse chips must be well graded to insure minimum voids, and screen analysis commonly shows 50 to 60 per cent passing the $\frac{3}{4}$-in. sieve. Each stock-site stores the approximate proportions of small and coarse chips, separately piled.

Bituminous oil is received in tank-car shipments at convenient points, where it is pumped into 12,000-gal. storage tanks. From storage it is taken to the work as needed in barrel lots or in 1,000-gal. tank-trailers. The oil commonly used meets one of the several common specifications for coldpatch and may be refined cold tar, asphalt cut-back or asphalt emulsion. Fairly rapid-setting characteristics are desirable in these coldpatch oils.

The surface depressions are located by a 16-ft. straightedge and marked on the road surface with lumber crayon. Depressed edges are similarly defined by a cross-sectional templet. If the maximum depth of depression is greater than 2 in. it is usual to build up the pavement by two or more patches in layers. In such event the portion of the old surface beneath the first patch is painted or primed with $\frac{1}{4}$ to $\frac{1}{3}$ gal. per square yard of the coldpatch oil. In single-layer patches the prime coat is omitted unless the texture of the existing pavement indicates the need of a seal.

Chips of the coarser size are deposited direct from a truck into the depression as marked and are struck to proper elevation with hand tools and with the straightedge, the smaller-sized chips being used around the fringes of the patch where the depth is less. On this dry stone the bituminous oil, slightly warmed in a heating kettle, is sprayed by hand from an ordinary water sprinkling pot having the rosette holes enlarged by driving an eight-penny nail through each hole. Hand pressure-pump spraying, when available, is also used.

The patch is twice sprayed from opposite directions to insure coating all exposed surfaces of the chips, but it is found that the application of the oil should cease just before the stone particles are entirely blackened, and should overrun the fringes of the patch about 6 in. onto the surrounding macadam. The openness of the aggregate permits sufficient bitumen to pass through satisfactorily to prime the underlying surface. A light coat of the small chips (10 to 15 lb. per square yard) is at once cast over the surface of the patch, which is thrown open to traffic to compact. A surprisingly small amount of the chips are cast off by traffic, the action seeming rather to be that of compacting and ironing out the patch.

It is realized that the method is quite old-fashioned and perhaps out-moded, but under moderate traffic up to 1,000 vehicles per day it has produced gratifying results. We would not assert that the resultant patch is superior to one made from locally machine-mixed or from commercially produced patching aggregate, but we have found this style of patch rapidly made and readily feather-edged, which is not always the case with prepared materials. No claims are made that the method is a panacea; it is cheerfully admitted that patches deficient in binding qualities must later be again spray-treated, and it is asserted that the entire operation should be construed as a step in routine maintenance rather than an end in itself. We have in mind instances where rough macadam surfaces have been transformed into satisfactorily smooth surfaces by patching at a cost of $300 per mile followed by a dragged-surface treatment at $900 per mile, the results being such as might have been expected with more expensive resurfacing methods.

The favorable features may be summarized as follows: (1) Materials are indefinitely stored, conveniently at hand, without deterioration. (2) The minimum amount of equipment is required and such tools as are needed are very simple and inexpensive. (3) Patches are speedily and economically made and smooth riding edges and surface areas are obtained.

Irregular surface settlement patched to smoothness

Small aggregate apparent at fringes of patch. Previous year's patching indicated by darker areas at right edge of road.

Rotation Raises Strength of Concrete Test Cylinders

Increase greater with higher water-cement ratio—Mortar matrix adheres to opposite faces of large aggregate—Cylinders break with columnar fracture

By L. E. HOUGH
University of Washington, Seattle, Wash.

STRIKING INCREASE in the compressive strength of concrete test cylinders was produced by occasional rotation of the specimens during setting in recent experimental work at the University of Washington. The increase was from 16 to 40 per cent above the strength of cylinders allowed to set in the ordinary manner; it varied in direct relation to the water-cement ratio. Observation of the rotated cylinders after breaking

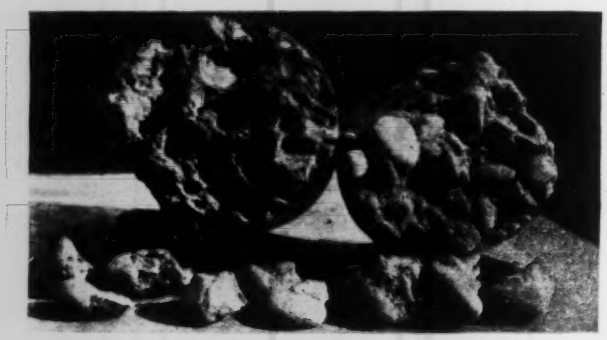


Fig. 1—Mortar matrix adheres only to upper side of coarse aggregate after breaking standard test specimens

showed a distinctly columnar fracture rather than the usual conical failure, and mortar matrix adhered to both top and bottom of the large aggregate particles.

Previously, routine work with test cylinders had indicated that the mortar matrix adheres to the upper side of the individual pieces of aggregate. Evidently the bond between paste and aggregate is weaker on the under faces of the stone, probably because of water rising from the layers of paste underlying each stone and forming a film on the under side. Tests were therefore undertaken to check this conclusion.

Six sets of four standard 6x12-in. test cylinders were made, with w/c = 0.7, 0.9, 1.0 and 1.1. The same grading of aggregate was used, and the slump was constant at 2 in.

For each series of constant w/c the material for the six specimens was mixed together in one pan. The mixing of each batch was done in a definite manner (twice dry and four times wet) to insure the same degree of mixing for all batches. In defense of this diversion from standard practice, which requires the making of one specimen at a time, it is noted that the mean difference in ultimate strength of similar specimens was never greater than 11 per cent. The forms were filled in the standard manner, and the ends capped with rubber gaskets and square steel plates with edges parallel.

Three of each series of six specimens with the same w/c were allowed to set undisturbed in the ordinary upright manner. The other three were placed successively in six different positions for 5-, then 10- and then 15-min. intervals. For example, during the first half-hour the cylinder was placed for 5-min. periods in each of the following positions: on one end, on the opposite end and then on its side in four different positions, determined by the parallel faces of the square steel capping plates. Following this series of movement at 5-min. intervals, it was repeated at 10-min. and then at 15-min. intervals. This schedule of changing position required three hours; it was assumed that the initial set had

Fig. 2—Specimens occasionally reversed during setting broke with columnar fracture

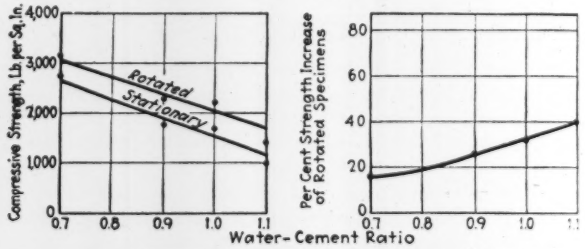


Fig. 3—Rotated specimens show material increase in strength and greater per cent of increase with higher w/c ratio

taken place during that period and that any free water rising in the specimen had come in contact with all sides of the aggregate. The stripped specimens were stored in a moist closet and were tested after seven days. In testing, the specimens were capped by a $\frac{1}{4}$-in. thickness of cardboard.

Results—Most of the rotated cylinders broke in a peculiar manner. On being removed from the testing machine they were found to be fractured into from two to six vertical pieces (Fig. 2). The individual pieces of aggregate taken from these specimens were found to have cones of mortar adhering to the two opposite faces on the line of the axis of the cylinder. In each series with constant w/c the rotated cylinders had a higher strength than those kept stationary. The percentage of strength increase was greater in the specimens made with the thinner pastes amounting to 16, 26, 32 and 40 per cent rise for w/c of 0.7, 0.9, 1.0 and 1.1, respectively.

Conclusions—From observation of the broken test specimens it is concluded that in the setting of concrete the free water separates from the paste and rises in the specimen until it comes in contact with the coarser aggregate. This water adheres to the aggregate, and the resulting film weakens the bond between the aggregate and the mortar matrix. If this is a correct conclusion, it would explain a part of the loss in strength accompanied by an increase in the water-cement ratio, because an increase in water content would result in a thicker film of water underlying each piece of aggregate. The remaining loss in strength, naturally, is due to the lower concentration of cement grains in the wetter paste. The reversed cylinders were stronger because the film resulting from the separated water was distributed more evenly over the surface of the aggregate.

Broad Border-Line Topics Discussed at Civil Engineers' Meeting

Highway, sanitary, surveying and mapping, engineering-economics and finance and city planning divisions hold sessions at summer meeting in St. Paul, Minn.

Engineering News-Record Staff Report

ECONOMICS and subjects more closely attuned to present-day business conditions than to matters of pure engineering interest claimed an unusually large amount of time at the three-day meeting of the American Society of Civil Engineers Oct. 7-10 at St. Paul. Contrary to expectations, the meeting was well attended, with a registration of nearly 400, including 80 students. The sessions of the five technical divisions were characterized by more than usual seriousness. In accord with the major engineering interest of the locality, iron mining trends and taxation, railroad economics of the Northwest and the half-completed local five-year development program of the city of St. Paul made up the two general sessions.

Notable on the division programs were the submission by the sanitary engineering division of material for two manuals on sewage-filtering materials and the launching of the new engineering-economics and finance division with a definite plan for a complete study of the economic problems involved in fixing bridge clearances over navigable waterways.

In the call-to-action address of the president, Francis Lee Stuart, there was an exhortation to the engineer to be more than scientist, inventor, designer or constructor by making his technical judgment and advice more helpful in the counsels of man. On this subject he said: "In addition to contributing technical knowledge to help our prosperity, we should direct more of our individual energies toward taking our place with the forces which decide ways and means and the uses to be made of our material progress. By that I mean that we must cooperate with all other forces to see that the world's work is directed by clear thinking, that the ability to secure the mental and physical equipment to produce wealth does not destroy our wealth and that the greatest use to be made of our material progress is to improve living conditions and standards and to see that wealth is properly distributed for the happiness of all.

"Labor-saving devices, machinery and anything else that cuts down the cost of production of wealth or produces more wealth that is useful to the world are to be eagerly sought for. If we thereby thrust men out of one branch of employment they will be absorbed by new occupations that will be found. We are not through improving living conditions; we are just beginning to see the necessity of research to find means for a more equitable distribution of things that lead to contentment, and the future holds far more advances than the past. If we can find a way to a more equitable distribution of our wealth and prosperity to all who are willing to pay their way by work, there will be a demand that will put all available men to work."

The other outstanding contribution and thought-provoking paper of an economic nature related specifically to the outlook for the individual engineer. In a long, carefully stated analysis of the present trends in the profession F. H. McDonald, Atlanta, Ga., secretary of the new engineering-economics and finance division, sounded a note of optimism. The engineer needs to broaden his horizon and take the leadership, initiative and direction not only of "the commodity services of design and supervision" but everything else in the way of conception, finance and operation of projects, in the way of creation of demand and development of markets of every auxiliary and tributary feature that goes to make the project a possibility and a success. This larger work is Mr. McDonald's answer to the competition that is restricting the field of the private engineer in every line of activity.

"Engineering," he stated, "is the creation of mediums of purchaseable usefulness in that the structures or methods it creates must stand the very acid test of economic use and justifiable cost, or not be brought into existence.

"These creations, from the standpoint of the engineer, may be bridges or canals, dams, mines, railroads and terminal facilities, buildings, highways, machinery of manufacture or of power generation—all the physical evidence of the progress of mankind in the creation of useful means for the furtherance of the comfort, convenience or recreation of society. Primarily they must be worth the money or not be built. They must stand the test of investment analysis, for they are the final evidence of wealth."

Regional Problems

Economics of the iron mining industry as presented by Prof. Davis, director, U. S. Bureau of Mines, brought out clearly the peculiar system of taxation by which the rich ore of Minnesota will be depleted in 35 years because it is taxed as long as left in the ground. The low-grade ore, of which there is enough to last several centuries, is in consequence not being concentrated in any large quantity, although the ore companies have started a few concentration plants. Canada pays 50c. a ton royalty to the ore companies to induce them to operate, whereas Minnesota levies taxes of that amount—39c. ad valorem tax, going mostly to local bodies, and an occupancy and royalty tax of 11c., going to the state. South Africa and Canada have rich ores, and unless Minnesota mends her tax methods she will find the ore companies going to the foreign ore bodies. In amount the tax is large. In 1929 $6,500,000 went to the state, $3,250,000 to the counties and $12,300,000 to the municipalities. The cities used all of the money except $2,000,000 for other than permanent purposes; hence they are spending capital resources.

Prof. J. C. Lawrence, dean, University of Minnesota, described the work of the Institute of Industrial

Research in Minnesota. This body is jointly endowed with $512,000 by the Carnegie, Rockefeller and Spellman foundations to study the unemployed, and 40,000 workers have been classified and are being followed up. This "case" information is being digested and the first general conference will be held at the university on Nov. 9 and 10. Prof. Lawrence deplored the fact that such a great number of workers have rushed into or are involved in the "cycle of production and distribution." After classification he believes people can be routed into channels where their handicaps will not be fatal to their success. More specific for the engineers was a statement as to the capacity of industry to absorb talent instanced by the great number of aviation engineers being turned out by the universities with so few needed. Correlation of the talent-absorption capacity of industry with the output of educational institutions is highly desirable, in his opinion.

Transportation in the Northwest

W. L. Darling, veteran railroad consulting engineer, spoke on the economic phases of railroading in the Northwest as exemplified by the Northern Pacific, the Great Northern and the Milwaukee. Likewise, economic reasons for the upper Mississippi waterway were presented by Hibbert M. Hill, engineer, U. S. Engineer Office, St. Paul. One reason given for the development of the 9-ft. project was the shrinkage of Middle West traffic to the Pacific Coast due to the Panama Canal and the restoration of water competition rates, which now give Duluth a differential of 5c. to 10c. per bushel over the Twin Cities. As much as a billion bushels may be involved. A maximum of 15,000,000 tons traffic upstream, mostly coal from the Kentucky-West Virginia fields, as compared with 5,000,000 tons of grain and miscellaneous products downstream, makes a decided inequality of distribution, with the heavy haul against the current. If all of this traffic could be diverted from the railroads a saving of $12,000,000 could be shown, according to Dr. Hill. The cost of the completed project has been estimated at $124,000,000 and the annual maintenance cost will be $1,750,000. The flowage damage is estimated at $13,000,000. About $45,000,000 was spent on the old 4½- and 6-ft. projects. Work authorized in 1930 is now progressing at a dam at Rock Island, dredging and a lock and dam at the Twin Cities and at Alma below Lake Pepin.

City Planning at St. Paul

The St. Paul development program was described by W. N. Carey, chief engineer, department of public works, St. Paul. Luckily the $16,000,000 recommended as feasible for a five-year period without undue burden on the taxpayer was made available by bond issue two years ago so that St. Paul today shows a minimum amount of depression distress. Much work on street widening, park development, an airport, a city auditorium and a county building is now under way. He detailed the work of the "selling agency," the United Improvement Council, organized in 1927 and made up of representatives of all the various civic organizations.

George H. Herrold, managing director, City Planning Board, read a paper on "Planning the City of St. Paul," dealing largely with the history of St. Paul, since analysis of the historical background of existing developments is the method by which the planning board of the city approaches its problems. This paper is one of a series the city planning division has had presented on the planning of capital cities.

A detail of basic design is of special interest. Mr. Herrold stated that it was not possible to lay down a rule as to total definite street width. Rather the street must have a width sufficient for the roadway, the sidewalls and parkway if any. A 56-ft. roadway is most efficient for industrial streets and 27 or 36 ft. for a roadway on residential streets is ample. Sidewalks are a separate and distinct consideration. Corridors and lobbies in buildings and aisles in theaters are determined as to their area by the number of people who will use them. In consequence the floor area of abutting buildings is the starting point for sidewalk width determination. In St. Paul in the congested high value district arcades along the street or in the form of a maltese cross through the center of the block have been built to the extent of 1,000 lin. ft.

Another feature in St. Paul is the consolidating movement of street cars on certain streets to make other streets available wholly for automobile traffic.

Carrying on public improvements in dull times is an excellent thing, Mr. Herrold said, but it is more difficult to prove benefits, thus requiring a larger amount be paid from general funds. City planning street projects completed since 1921 and those now under way to be completed in 1933 total 18.8 miles. Platting is controlled by a master thoroughfare plan. Long blocks, 880 to 1,320 ft., are being accepted in residential districts. Publicly dedicated walks for pedestrians are provided in these long blocks.

Robert Kingery, general manager of the Chicago Regional Planning Association, in a description of the work of that body stated that for seven years two basic policies had been rigidly adhered to: coordination of the many municipal, county and state plans into a composite whole and the making of independent investigations of planning principles so that these plans may be laid upon sound and scientific foundations. For instance, provision is being made for 110 acres of space for each 1,600 persons divided as follows: 4 acres for industrial; 1½ for business; 80 for residential; 10 for parks, playgrounds and schools; 8 for outer parks and forest preserves and 6 acres for golf. To these must be added the areas devoted to railroads, power lines, watercourses, farms and vacant lands.

In discussion John P. Hallihan, chief engineer, Rapid Transit Commission, Detroit, referred to the progress and disappointments in Detroit where, of $27,000,000 on local improvements only 44 per cent followed recommendations of the commission, 25 per cent of street widenings were less than recommended and more than 25 per cent was devoted to streets that had no relation to the plan.

Highway Parasites

Minnesota was one of the first states to prohibit advertising signs on the highways. C. L. Motl, assistant engineer, Minnesota state highway commission, read a paper by C. M. Babcock, commissioner of highways, on these and other highway parasites. Toll bridges he so classified. Minnesota has but one that is within its boundaries, though it has several interstate toll bridges. The paper severely condemned the ride-begger, as he called hitch-hikers. Hitch-hiking is a misdemeanor in Minnesota and seven other states, but enforcement of this law is badly neglected. Education of the driver to a hard-boiled attitude is the most productive method of caring for the nuisance.

"Location of Highways" was the subject of a paper presented by Walter Schultz, locating engineer, Minnesota state highway commission. Many examples were given of relocations to meet the higher speed characteristics of modern traffic. He noted the strangling effect of roadside development when not controlled along widened thoroughfares. Cross-traffic interference becomes serious as soon as the area builds up a block away from the main road. Parallel service lanes were suggested as the remedy.

Surveys and Mapping

A paper by Prof. J. S. Dodds, Iowa State College, on "The Recovery and Identification of Original U. S. Government Section and Quarter Section Corners" presented much that will be valuable to the young surveyors in tracing old lines.

A paper on "Surveys of the Upper Mississippi," by Lenvik Ylvisaker, engineer, U. S. Engineer Office, Upper Mississippi Valley Division, St. Louis, described methods used in making quick surveys of the upper Mississippi as a basis for developing the 9-ft. channel. It was apparent from the general knowledge of the river that simply a line map would be required for certain portions, while on other sections it would be necessary to have contours. It was decided to make surveys by photography. Although the river was surveyed by the Mississippi River Commission in 1901 and complete contours were taken, it was decided to discard this survey completely excepting the triangulation points and make an entirely new survey because of the many changes that had taken place in the terrain.

Bridge Clearances Being Studied

The engineering-economics and finance division as its first study has taken up the controversial subject of bridge clearances over navigable waterways. John F. Coleman, consulting engineer, New Orleans, heads a committee on the subject, which is collecting information on waterways used by many vessels, streams denominated navigable but not used or infrequently used by vessels and the vertical clearance necessities.

Henry K. Dougan, executive assistant, Great Northern Ry., in discussion instanced three expensive examples of bridge clearance requirements where water commercial use had ceased. The upper stretches of the Mississippi, Missouri, Columbia, Okanogen and Lower Yellowstone were noted as streams where navigation interests had cost the railroads vast sums and now bid fair to cost equally large sums to the highway bridge builders.

Col. George R. Spaulding, Corps of Engineers, U. S. Army, St. Louis, indicated that there was now being made an intensive study and classification of streams which would release many of them from the navigable class. To expedite the getting of permits he suggested that engineers come early to the U. S. Engineer's Office, when contemplating bridge locations. J. N. Chester, consulting engineer, Pittsburgh, recounted many controversies and arbitrary rulings wherein he was always told that the rights of navigation were "paramount" to any other traffic needs. Finally he got the U. S. Engineers to admit that there was no law giving any such paramount precedence. Col. Spaulding said that all factors would be taken into consideration, but the U. S. Engineers would surely not disregard the needs of navigation on such projects as the Ohio River, where millions had been spent, and would fight to protect them from undue encroachments.

Ralph Budd, chairman of the division, asked if an international agreement on outside clearance dimensions for waters used internationally might not be feasible. Col. Spaulding felt that this would be an excellent step toward establishing a yardstick, but every case would need separate consideration.

Sanitary Engineering

A well-attended meeting of the sanitary engineering division gave attention to a paper by J. A. Childs, chief engineer and secretary, Metropolitan Drainage Commission, outlining the efforts which have been made to provide ways and means for solving the sewage-disposal problem of the Twin Cities. This problem has been intensified during recent years by the construction of the Twin Cities lock and dam, forming a pool through Minneapolis, and by the Hastings Dam, forming a pool through St. Paul. Sludge deposits rising to the top of the pool in summer and the depletion of the oxygen in the water have caused serious nuisances. After considerable investigation, the commission has recommended the construction of a single treatment plant at Pigs Eye Lake below St. Paul to comprise sedimentation, separate sludge digestion and activated sludge treatment at an estimated cost of $10,000,000 for intercepting sewers and $3,800,000 for treatment works, the sewers being designed for 1970 conditions with total capacity at the outlet of 400 m.g.d., and the treatment works with a capacity for 1940 with progressive development starting with only partial treatment. An act passed by the recent legislature creating a Metropolitan Sanitary District and providing for assessing the costs, including the treatment of South St. Paul packing house wastes, on the basis of property values was vetoed by the governor due to strenuous opposition from Minneapolis. The present tentative program includes treatment of the sewage from Minneapolis and St. Paul with the packing house wastes omitted.

A description of the Grand Rapids sewage-treatment plant was given by Milton P. Adams, engineer, Michigan Stream Control Commission, and C. R. Velzy, including some of the history of the development of the project dating back to the supreme court order of 1913, directing the city to install sewage-disposal works. Extensive remodeling of the sewerage system with the construction of relief and intercepting sewers resulted in the collection of sewage at a central pumping station for both stormwater and dry weather flows. Troubles with flooding of equipment in the first pumping station, constructed with horizontal pumps, led to the use of vertical pumps in the second section. The treatment works, including grit basin, sedimentation and separate sludge digestion, were put into operation in October, 1930. The design includes activated sludge to be included later as final treatment. The first installation is designed for 250,000 population, with provision for doubling the plant capacity.

A paper on "Trickling Filter Loadings," by J. A. Childs and George J. Schroepfer, assistant to Mr. Childs, brought out the conclusion that for a given installation the efficiency of operation as measured by the reduction in B.O.D. (biological oxygen demand) was constant, irrespective of the strength or quantity of the applied sewage. Operating data from fifteen trickling filter plants were plotted, using B.O.D. load applied as abscissas and B.O.D. removal as ordinates. These data gave straight lines. The same relation was found by N. T. Veatch, Jr., consulting engineer, Kansas City, based on data from the Lawrence experiments and operation of the Columbus

(Ohio) plant and by L. F. Warrick from the results of an experimental trickling filter treating strong dairy wastes. S. A. Greeley pointed out that using more complete data from the Decatur (Ill.) and Fort Worth (Tex.) plants a slightly curved line could be plotted as easily as a straight line with considerable change in the indicated percentage removal of B.O.D. William D. Galligan stated that the results of operation of an experimental filter treating dairy wastes at Ames, Iowa, showed variations in the percentage removal of oxygen consumed with variation in strength of applied load.

Filtering Material Reports

The committee on filtering materials for water and sewage works, W. E. Stanley, chairman, submitted a progress report covering the work done during 1930 and the first nine months of 1931. Along with the progress report two final reports were presented, one relating to the selection, the testing for durability, the preparation and the placing of filtering material for trickling filters, and the other relating to fine-grained material for intermittent sand filters and sludge drying beds. Two uncompleted items of study remain for the future activities of the committee. These include (1) the relation of the filtering material to the safe loadings for trickling filters with particular reference to size, uniformity of size, roughness or smoothness and shape of the filter medium; and (2) sand for water filters, with particular reference to the effects of size and uniformity of size on the efficiency of filtration and of backwashing under various characteristics of the water to be filtered.

The report on filtering materials for trickling filters covers the selection of the source of the material for the installation, the tests to be made to determine the relative rating of various available materials as to probable durability, and the methods of preparation and placement. No recommendation was made as to the selection of the type of filtering material as between slag, crushed stone, gravel and the like, as there are insufficient comparative operating data to permit a definite determination of the relative effects of these general characteristics.

It is possible, the committee reports, that much of the difficulties attributed to deterioration of the medium in existing plants is actually due to improper preparation of the material as originally placed. The report places special emphasis on screening and cleaning.

On fine-grained material for sewage filters the report states that there are some 400 municipal installations of intermittent sand filters in the United States, many of which are operating very inefficiently. The primary causes for the poor results in the operations are the placing of improper material in the filter bed at the time of construction and deterioration due to insufficient attention or improper loadings during operation. The committee is of the opinion that there is a definite place for the use of intermittent sand filters, particularly for small sewage-disposal plants and as a finishing process where a high degree of treatment is desirable.

In its work on filter materials for waterworks, the committee is cooperating with a recently appointed committee of the American Water Works Association to deal with the same subject. A program of cooperative research is being undertaken with the filtration departments of sixteen cities. The principal objectives of the test include the relationship of filtration and sand sizes with reference to the ability of filters to prevent passage of floc, the length of filter runs and the relation of sand size to filter washing procedure.

Municipal Works in the Soviet Union

DEVELOPMENTS in the field of municipal work and housing are receiving considerable attention in the Soviet Union at the present time, according to an article in the *Economic Review of the Soviet Union*. Despite the improvements made in recent years, it will be a tremendous task to raise the standard of housing and sanitation in the U.S.S.R. to the accepted level in the advanced industrial countries. The inheritance from pre-war Russia in this respect was an exceedingly poor one. For instance, only nineteen cities out of 1,063 in the empire had sewerage systems, about 200 had central waterworks, 34 cities had street-car lines and 32 possessed municipal gas works.

With the inauguration of the five-year plan in 1928 municipal economy and housing received much attention. Investments for this purpose in the past five years have totaled more than $1,750,000, including the planned expenditure for the current year. Water-supply systems in 131 cities, sewer systems in thirteen cities and street-car systems in ten cities are to be completed before the end of 1931. Since 1917, 114 new water-supply systems have been installed throughout the U.S.S.R., bringing the present total to 333; only 219 cities with a population of more than 10,000 had water systems before the war.

There are now sewer systems in 32 cities, as compared with only 19 in pre-revolutionary Russia; in several other cities new sewer systems are now being built. The extent of the sewer systems in the larger cities varies from 35 to 80 per cent (an average of 65 per cent) of the area embraced by the water-supply systems. Capital investments for this year to improve sewerage total $40,000,000, which is almost four times that of 1929-30.

At the beginning of this year 43 cities had street-car systems, as compared with 34 cities in pre-war Russia. The question of building a subway in Moscow has been considered for some time, and it is expected that construction will be begun next year.

Quite the most far-reaching innovation is that of central heating on municipal lines. Prior to 1926 this method of supplying heat was virtually unknown. The U.S.S.R., because of its system of unified control of the economic system, is in a particularly favorable position to utilize the heat generated in industrial enterprises and regional power plants for heating dwelling houses, public laundries and baths, as well as for factory kitchens. Leningrad has the first and largest municipal heating system in the Soviet Union; it is second in extent in Europe, Hamburg taking first place. It is planned to extend central heating to agricultural districts through the system of collective farms. For this purpose it is recommended that all industrial-agricultural activities that require steam and hot water (such as dairies, sugar plants, bacon curing, woodworking centers, etc.), be centered around power stations. The use of gas for cooking purposes was rather limited in pre-war Russia. In Moscow the city gas supply in 1913 totaled only 600 million cu.ft. During the first two years of the five-year plan an additional 1½ billion cu.ft. was made available.

Throughout the Soviet Union the lack of good roads and streets constitutes a very serious problem, especially for automobile traffic. A plan for repaving the Moscow streets was recently ratified and provides for work on 688,000 sq.yd. this year.

ENGINEERING LITERATURE

A Monthly Review of Books and a Listing of New Publications

High-Speed Turbine Runners

REVIEWED BY EUGENE E. HALMOS
Chief Engineer,
Parsons, Klapp, Brinckerhoff & Douglas,
New York City

THEORIE UND BAU VON TURBINEN-SCHNELLAUFERN—Von Professor Dr. Ing. Dr. Techn. H. C. Viktor Kaplan of Brünn, and Prof. Dr. Techn. Alfred Lechner of Vienna. Munchen and Berlin: R. Oldenbourg. Cloth; 7x10 in.; pp. 301; 219 line cuts and halftones. 18 marks.

MODERN low-head hydro-electric developments require the installation of large turbines running at high speed and operating with an efficiency approximating the high values attained by the improved types of Francis wheels designed for medium heads. These requirements are fulfilled by the propeller-type turbines, several designs of which are in use in all parts of the world, such as the Lawaczeck, Moody and Nagler. All these have the common characteristic that their efficiency is but little influenced by a change in head of reasonable proportion to the normal, while on the other hand their efficiency is materially reduced when operated under part gate.

This unsatisfactory feature of the propeller-type turbine is claimed to be remedied by the author's invention in making the angularity of the wheel blades changeable with the degree of gate opening so that the efficiency of the Kaplan turbine is almost constant for both the variation of head and gate opening between about 35 and 100 per cent of normal.

Prof. Kaplan's invention naturally aroused great interest among engineers designing hydro-electric plants, but little information could be gained from the scattered articles about this turbine which appeared in the technical literature.

The book under review, however, gives as much information on the Kaplan turbine as it was possible for the inventor to publish without disclosing the complete details of its design and construction. The author states that he was "afraid that complete disclosures may harm the licensees of my patent."

The book is divided into three main parts. The first 129 pages are devoted to a brief but complete hydro-dynamic treatise on multi-dimensional flow, written by Prof. Lechner. In the second part (111 pp.) the practical application of the multi-dimensional flow theory to the design of turbines is given. The theory is applied to medium-speed (specific speed between 55 and 80) Francis runners, high-speed (specific speed between 80 and 135) propeller runners and extremely high-speed (specific speed between 135 and 225 and over) Kaplan turbines. It also includes a mathematical analysis of the action of draft tubes. The third part describes a number of completed installations, together with the characteristic curves applying to some of the turbines.

While the book primarily is a textbook for turbine designers, it should find a place in the library of the civil engineer designing hydro-electric plants. The time has arrived when the engineering profession should become acquainted with the modern theories of flow which as yet are not part of the regular courses in the American colleges. This subject is presented by Prof. Lechner in a very clear manner so that it can be understood by any student who has a reasonably good mathematical foundation.

In the application of the theory to turbine design and construction, Prof. Kaplan gives highly practical explanations of the nature of the flow and its action in the turbine and in the draft tube, and on the whole character of the conversion of the kinetic energy of the water into useful work. A great deal of information can be gained also from the data published on the large number of installations of Kaplan turbines, which have grown from 10,000 hp. in 1921 to a total of nearly 900,000 hp. in 1929.

For Simplicity and Speed

SURVEYORS' TABLES—By John F. Robisch, Licensed Surveyor, New York, New Jersey and Pennsylvania. Cloth; 4½x7 in.; pp. 109. $5 from the author, 745 Broad Ave., Ridgefield, N. J.

SIMPLIFYING and speeding up the calculation of surveys is the purpose of this volume, which contains the tables needed to convert field survey data into a final map or plan. The tables included give sines and cosines from 0 to 90 deg. by minutes for distances 1-9, inclusive; lengths of circular arcs (radius = 1) from 0 to 180 deg.; conversion of chains to feet; and tangents from 0 to 90 deg. by minutes. There are also two pages reviewing formulas for the solution of triangles.

Interpreting Business to Engineers

ECONOMICS FOR ENGINEERS—By Edison L. Bowers, Ph.D., Assistant Professor of Economics, and R. Henry Rowntree, Instructor in Economics, Ohio State University. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. 490; 43 line cuts. $4.

TWO YEARS of business stagnation have awakened thinking persons to the realization that the science of economics, once regarded as a plaything of theorists, codifies definite laws affecting the welfare of all strata of society, and that at least a general knowledge of this science is an essential part of a business or professional man's educational equipment. Such knowledge is particularly important to the engineer, not only because of the prominent part that technology is playing in modern business and industry but also because his class, in increasing numbers, is being called upon to supply responsible executive direction to large and small corporations. Familiarity with the principles of economics, always a distinct advantage, is an essential element in business leadership. Engineers in more strictly professional work are conscious of the same need, for every engineering project, regardless of its technical excellence, must remain a disembodied collection of estimates and blueprints until its sponsor shall prove its financial stability and justification.

In Dr. Bowers' "Economics for Engineers," as the title indicates, the science of economics is described and analyzed from the viewpoint of the engineer. Treatment of the subject departs from the conventional in three

important particulars: A serious attempt at conciseness is made in order to conserve the time of the student; the scope of the discussion is extended beyond the sphere of pure economic theory to include certain important aspects of business not usually touched upon in the average college course; and the interests of the engineer are used to determine the relative emphasis of treatment. The responsiveness of the authors to present-day problems is indicated by the attention given such subjects as occupational hazards, the public control of business, socialism and the Russian experiment, and government finance and taxation.

Concentration of Control

CONCENTRATION OF CONTROL IN AMERICAN INDUSTRY —By Harry W. Laidler, Ph.D., Executive Director, League for Industrial Democracy; President (1930-32) National Bureau of Economic Research; author, "History of Socialist Thought." New York: Thomas Y. Crowell Co. Cloth; 6x9 in.; pp. 501. $3.75.

DR. LAIDLER'S chief aim in writing "Concentration of Control in American Industry" was to marshal the facts. This he has done in a masterly way under six main heads: natural resources, public utilities, manufactures, finance, marketing, agriculture. These descriptive and statistical chapters are preceded by a concise historical sketch and followed by chapters on "The Law and Industrial Concentration" and "Interpreting the Trend."

Almost everyone will agree with the author that the trend is toward a greater and greater centralization of control—of production, distribution, capital and management. This concentration has come partly through centralization of ownership and largely through many ingenious corporate devices, still to a great degree outside government control even in this day of state and federal regulation. The final outcome the author leaves to the future, concluding his book as follows: "This is not a book of prophecy. It is primarily a book of facts, of trends in economic controls, and if it calls attention to these trends in our fast changing industrial system, demonstrates that the days of the old individualism are past and furnishes a basis in fact for future constructive action, its mission will have been fulfilled."

Fast Disappearing

COVERED BRIDGES OF NEW ENGLAND—By Clara E. Wagemann. Rutland, Vt.: The Tuttle Co. Brown calf; 7x10 in.; pp. 158; reproductions of fourteen etchings by George T. Plowman, 33 wash drawings and map showing toll bridges over the Connecticut River between Vermont and New Hampshire. Limited edition of 500 copies, signed by the author. $12.50.

WITH an abundance of timber and a superabundance of stone to draw upon, the pioneers of New England chose timber to bridge their many streams. Workers in wood rather than in stone, skilled in handling the axe, the adze and the broadaxe, they felled trees and hewed them into shape. As sawmills multiplied and became more efficient, sawed largely replaced hewn timber. Then came those masterpieces of bridge carpentry, the lattice girder and built-up arches. To preserve the framework and the flooring, as well as to keep the heavy winter snows from the roadway, these wooden bridges, if of much length, were roofed with timber and shingles. In addition, the sides were usually boarded to keep out rain and snow. Roof and sidings together made a "covered bridge." Given good abutments and good care, these bridges were long lived, but they had two great natural enemies, fire and flood. If the builders of these covered bridges had been as good masons as they were carpenters much of flood menace would have been averted, but not the danger of being floated downstream by heavy floods, which sooner or later was the fate of hundreds of covered bridges. Heavy onslaughts on these bridges were made by the adoption of wrought iron, steel and concrete bridges.

The New England floods of 1927 destroyed a large part of the covered bridges that were still left, taking, for instance, the only remaining one of six known to the writer in his boyhood in one Vermont town. Traffic demands are causing other covered bridges to disappear. For all these reasons Clara Wagemann's "Covered Bridges of New England" is most welcome. It contains a series of brief historical and descriptive notes, mostly on specific bridges and a few outstanding bridge builders. Nearly 50 of the bridges noted are illustrated by reproductions of etchings and pen-and-wash drawings. The somewhat high price of the book is caused by its handsome make-up and the fact that the edition is limited to 500 copies.

Prosperity and Inflation

PROSPERITY PROBLEMS: "Why, Whence, Whither' and With What Part in World Welfare?—By Arnold G. Dana, from 1887-1922 on Statistical-Editorial Staff of *Commercial and Financial Chronicle*. New Haven, Conn.: Tuttle, Morehouse & Taylor Co. Cloth; 6x9 in.; pp. 451; tables. $3.50.

A WEALTH of material and comment on the happenings of the past ten years of prosperity, inflation and deflation have been brought together by A. G. Dana under the title "Prosperity Problems." The material took shape from 1919 to the first part of 1931, but it is here presented in inverse order—that is, the first hundred pages are written from the 1930 and early 1931 viewpoint, and the remainder is of earlier date, going back to articles contributed by the author to the *Commercial and Financial Chronicle* Aug. 23 and Dec. 6, 1919. The main theme of the book is inflation in almost everything, including wages. Considerable attention is given to engineering and building construction, in connection with cost, and index figures from *Engineering News-Record* are given.

Publications Received

WASTE DISPOSAL AND BYPRODUCT RECOVERY is the general subject of ten specially contributed and a number of staff articles in *Chemical and Metallurgical Engineering* for September ($1; 330 West 42d St., New York City). Among the special writers are Abel Wolman, John R. Baylis, F. W. Mohlman and L. H. Enslow. Industrial wastes, sewage and smoke are three of the subjects of the issue.

SALIENT FEATURES in 25 years' work on the water supply of London and vicinity are outlined in the report of Sir Alexander Houston, director of water examinations, Metropolitan Water Board, for the year 1931 (21 shillings from P. S. King & Sons, 2 West Smith St., Westminster, England). In addition, the chemical and bacterial work of the year is reviewed in text and tables, and the reader is offered a description of a trip up the Thames to the larger filter plant at Walton. In the 25-year review attention is given to chlorination and many other phases of water treatment. Surprising to most readers will be the reproduction, both in type and photographically, of a letter written a hundred years ago by Michael Faraday to W. Tierney Clark, engineer of the West Middlesex Waterworks Co., in reply to a request for information about a "green substance" sent to Faraday by Tierney. Faraday disclaimed ability to "answer all sorts of

questions," especially when put to him "almost in the manner of riddles," but supposes the substance was "a conferva." As "to stopping its formation," Faraday says: "I think it may be difficult, but I really can give no opinion, being entirely ignorant whether it is found in a large or small quantity of water, in light or in darkness, etc., etc., and even if I knew, then I do not know that I would give a much better answer."

THE ACTIVATED-SLUDGE PROCESS is the subject of three special reports in the general report on "The Treatment of Sewage From the Easterly Sewerage District" of Cleveland, Ohio, by George B. Gascoigne, consulting sanitary engineer (Leader Building, Cleveland, Ohio). The special reports are by Charles H. Hurd, Indianapolis, and Darwin W. Townsend, Milwaukee, and deal with settling tanks for use after activation; activated sludge in the fertilizer market; and the design construction and operation cost and probable revenue of an activated-sludge plant. Most of Mr. Gascoigne's portion of the report also deals with the activated-sludge process, which he recommends for the portion of Cleveland sewage tributary to the easterly outlet; but Mr. Gascoigne does not advise converting sludge into a commercial product.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

BIOGRAPHY OF THOMAS DAVENPORT, the "Brandon Blacksmith": Inventor of the Electric Motor—By Walter Rice Davenport, D.D. With an Introduction by Hon. James Hartness, LL.D., ex-president of the American Society of Mechanical Engineers. Rutland, Vt.: The Tuttle Co., Sales Agent for the Vermont Historical Society. Cloth; 6x9 in.; pp. 170; illustrated. $2.

After many struggles, financial and otherwise, Davenport obtained a patent on an electric motor in 1837. He died a dozen years later, at the age of 50. Decades afterward memorials to him were dedicated in the town of his birth and in Brandon.

COMMERCE YEARBOOK 1931: Vol. I, the United States—Compiled by U. S. Bureau of Foreign and Domestic Commerce. Buckram; pp. 696; line cuts and tables. $1 from Superintendent of Documents, Washington, D. C.

THE DESIGN OF DAMS—By Frank W. Hanna, C.E., M.Am.Soc.C.E., Chief Engineer and General Manager, and Robert C. Kennedy, C.E., M.Am.Soc.C.E., Chief Designing Engineer, East Bay Municipal Utility District. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 456; 87 illustrations, mostly line cuts. $5.

DESIGN OF REINFORCED-CONCRETE FLOOR SLAB from the Viewpoints of Strength and Economy. By L. E. Grinter, Ph.D., C.E., Professor of Structural Engineering. College Station, Texas: Texas Engineering Experiment Station. Paper; 6x9 in.; pp. 88; line cuts.

FIGHTING FIRES WHICH INVOLVE CHEMICALS—By L. K. Arnold and L. J. Murphy, Bulletin 109, Engineering Extension Service, Iowa State College, Ames, Iowa. Paper; 6x9 in.; pp. 30; five halftones.

GRAFT IN BUSINESS—By John T. Flynn, author of Investment Trusts Gone Wrong. New York: The Vanguard Press. Cloth; 6x9 in.; pp. 318. $3.

LINOLEUM-HANDBUCH: Ein praktischer Fuhrer fur Industrie und Handel—Von Dr. H. G. Bodenbender. Berlin-Steglitz: Chemisch-technischer Verlag Dr. Bodenbender, Feuerbachstr. 6. Cloth; 6x9 in.; pp. 506; colored and other illustrations. $4.

A comprehensive handbook on linoleum, its history, the various kinds in use, raw material and methods of manufacture, directions for laying and care; also descriptive list of patents and much other information.

PLASTICITY: A Mechanics of the Plastic State of Matter—By A. Nadai, Dr. Eng., M.Am.Soc.M.E., Research Laboratories of the Westinghouse Electric & Mfg. Co.; Member Faculty of Graduate School, University of Pittsburgh; formerly Professor of Applied Mechanics at the University of Göttingen, Germany; assisted by A. M. Wahl, M.S., M.Am.Soc.M.E., Research Laboratories of the Westinghouse Electric & Mfg. Co. [No. 1 of Engineering Societies Monographs]. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. 349; many illustrations. $2.50.

THE PORT OF MILWAUKEE, WIS. Prepared by the Board of Engineers for Rivers and Harbors, War Department, in Cooperation With the Bureau of Operations, U. S. Shipping Board. Paper; 6x9 in.; pp. 130; folding maps and halftones. 45c. from Superintendent of Documents, Washington, D. C.

Third in the series of monographs devoted to the lake ports. Many ocean ports have also been covered.

PROVNING AV BRANDSAKERHETEN HOS BYGGNADSMATERIAL OCH KONSTRUKTIONER I. Murvaggar — Av Ragnar Schlyter. Stockholm: Statens Provningsanstalt. Paper; 6x10 in.; pp. 62; illustrated.

Contains an English translation of the summary and conclusions (7 pp.) of this report on fire-resistance tests of brick walls.

REINFORCED-CONCRETE RESERVOIRS AND TANKS—By W. S. Gray, B.A., M.A.I. (Dublin), Assoc.M.Inst.C.E.I., M.N.Z. Soc.C.E. London: Concrete Publications, Ltd., 20 Dartmouth St., Westminster, S.W.1. Cloth; 6x9 in.; pp. 178; 119 line cuts and halftones. 10s.

A TEXTBOOK OF THERMODYNAMICS — By F. E. Hoare, M.Soc., Assistant Lecturer in Physics at University College, Exeter [England]. New York: Longmans, Green & Co. London: Edward Arnold & Co. Cloth; 6x9 in.; pp. 271; 49 line cuts. $4.50.

Primarily for those working for "an honors degree in physics"; also for "all who require a general introductory treatise on thermodynamics." Some of the mathematical discussions involve calculus.

LETTERS TO THE EDITOR

Gasoline Consumption and Automotive Use

Sir—*Engineering News-Record* has repeated a common error in the editorial "Killing the Goose" in the issue of Aug. 6. The statement is made that "the gas consumed per vehicle (automobile) increased more than 3 per cent (in 1930)." From this and the fact that motor vehicle registrations in 1930 failed to increase it is argued that indications are that "the period of more intensive use (of motor vehicles) is beginning."

Admitting that the number of motor vehicles registered in 1930 was no greater, for all practicable purposes, than in 1929, it is nevertheless true that the number of automobiles in use in 1930 was about 1,000,000 higher than in 1929, or roughly 4 per cent. Vehicles in use may be approximated by averaging the number registered at the end of any year with the number registered at the end of the preceding year. Computed in this way, vehicles in use in 1929 totaled about 25,500,000; in 1930, 26,500,000. When gasoline consumption increases 3.5 per cent and cars in use 4 per cent, it can hardly be said with any accuracy that automobiles are being used more intensively.

Trends in gasoline consumption compared to trends in motor vehicle registrations are not enough, however, upon which to determine, even approximately, trends in use. Variations in the relation that trucks hold to the total registration are decidedly important because of the higher annual mileage and fewer miles per gallon in the case of trucks. In addition, improvements in road surfaces, higher road speeds, higher acceleration and braking rates, increased street crowding, increased number of cylinders per car and changes in gasoline characteristics may all be expected to affect gasoline consumption favorably or unfavorably. Until more is known about these factors it is going to be very difficult to determine accurately the trends in motor vehicle use, based upon the annual consumption of gasoline in automotive vehicles.

HAWLEY S. SIMPSON.

East Orange, N. J.,
Sept. 23, 1931.

Too Many Graduates Lack Proper Training

Sir—I was much impressed in noting the letters in your Sept. 17 issue on the subject "Too Many Graduates?" and I wonder whether this discussion has yet touched upon the real truth in connection with the situation.

Our business contacts us with many branches of engineering. It is continually a matter of surprise and concern when we get at the facts in connection with individuals to realize how many of these "too many graduates" are lacking in their grasp and utilization of the backbone of all engineering, i.e., administrative mathematics.

By administrative mathematics I mean mathematics of the concrete kind, which enables men to grasp the physical significance of the relationships of a problem and to make a reasonably prompt start, whether numerically, analytically or mechanically, toward the needed objective, instead of turning to handbooks in the hope of finding formulas that will fit the particular situation.

It is seldom realized, I believe, that engineering has an extremely high professional mortality. According to the statistics, of 100 men embarking on an engineering training in our technical institutions 28 graduate. Approximately ten years after graduation of this 28, about 7 to 8 per cent remain. These eliminations from engineering ranks are brought about, with comparatively few exceptions, due to a lack of ability to correlate the mathematical treatment with the physical interpretation required by practice. More

serious than the loss of individual investment is the deflection of a man from a profession of his own choosing into other activities less in line with his inherent ability.

Broadly, my thought is that were a materially greater percentage of men to approach the engineering profession with a conscious physical grasp of the significance of its mathematics, there would be less of the sloughing off from the profession during the first ten years after graduation.

We need men who enter the profession with mental and physical equipment and a confidence in their ability to approach their problems with a reasonable certainty that there is "a way out"; not perhaps the most refined way, not resulting necessarily in ultra-accuracy as regards results, but rather through methods that permit visualization and "common sensing" of the engineering relationships incident to their design.

J. M. BARR,
President, The Integraph Co.

Cleveland, Ohio.
Sept. 21, 1931.

Friction Tests on Bearing Plates

Sir—The article in your issue of June 25 on "Friction Tests on Bearing Plate Materials" by Thomas E. Stanton, materials and research engineer of the California state highways division, has occasioned considerable interest and comment among bridge engineers, and the author is to be complimented on starting a research on materials in this field.

While we do not wish to detract from the value of this article as far as it goes, we wish to take issue with some of the conclusions that have been drawn. It is quite apparent that the article is being given too wide an application. The writer evidently intended it only as a guide for highway bridges requiring expansion plates where the unit load is 700 lb. per sq.in., or in that neighborhood, and where it is regular practice to use bronze on bronze and not steel on bronze. We note with considerable interest that it is apparently the practice of the California division of highways to specify bronze bearing plates in pairs—that is, with a bearing of bronze on bronze. Possibly our experience is not wide enough, but upon inquiry in the East we fail to find any highway bridge engineers following this practice. As far as we can determine, it is customary to use but one plate—that is, the bearing is steel on bronze. If this latter practice is the more prevalent, and we see no reason why it should not be, then the value of the test given in the article in question is only for the minority who deem it necessary to use bronze on bronze. Although we have no practical experience to illustrate or substantiate the theory, it is generally considered good engineering practice to place unlike metals in contact, unlike not only in physical characteristics but in chemical composition; and we are of the opinion that two pieces of like metal intimately in contact under high pressure over any length of time would tend to amalgamate and seize.

However, the principal point that we wish to make in regard to the article is that on expansion plates *the question of friction is not a factor* that deserves serious consideration as long as the two bearing surfaces are not actually corroded together. The force back of any thermal explosion is enough to overcome any initial friction, and as far as wear is concerned, the movement, generally speaking, on expansion plates is only one return trip of a fraction of an inch, or perhaps a little more, *per year*. We therefore submit that it really doesn't matter what kind of bronze is used for expansion plates as long as it will carry the load and not stick fast from corrosion.

We are of the opinion that research should be made on friction and wear in bridge bearings for the movable types—bascule, lift and swing. Here the power consumed in overcoming friction is a factor, and the number of movements or rotation is frequent enough to make wear a very serious matter, particularly if abrasion should occur. Another factor is strength, not only in compression but in tension. It is common knowledge that the existing specifications of the A.S.T.M. and the A.R.E.A. are antiquated and have not taken cognizance of developments during the past ten or fifteen years in the metallurgical field. Neither do they discriminate between the service requirements of the different types of bridge bearings as fully and as intelligently as they should. Quite aside from the bearing metal itself, too much stress cannot be laid on the choice of lubricant for different types of bearings under different conditions of operation and temperature. The lack of attention to this factor has led to serious trouble, which very frequently is blamed on the bearing itself instead of the real cause of the trouble, an improper lubricant. Design and machine work also contribute to the proper service of a bridge bearing. If either design or machine work or lubricant is faulty, it makes no difference what metal is in the bearing, and the best possible alloy can thus be ruined.

In conclusion, we wish to state that we have no objection to either the leaded phosphor bronze or lead-free phosphor bronze on bearings operating under conditions that come within the limitations of these metals. Their resistance to wear is unquestioned, and they are unequaled in the high speed bearing field where *wear* is the *principal factor*. The limitations, however, are in compressive and tensile strength and in elongation, which is the measure of brittleness. The hard high-tin bearing metals are particularly brittle. Generally speaking, all phosphor bronze bearings must be backed up all over, otherwise they will be subject to strain which may produce cracks. Compared with other bronzes available that have good bearing qualities, their compressive strength is low and their cost is generally higher. Of these other bronzes one or two stand at the head of the list and are being specified extensively by leading bridge engineers in the East. However, it is not the purpose of this article to discuss the merits of these bronzes, nor has the time arrived to take a definite stand as to which one is the best. Undoubtedly the problem will be put up to the A.S.T.M. and the A.R.E.A. for their consideration at an early date.

T. H. ADDIS,
President, American Manganese Bronze Co.

Philadelphia, Pa.,
Oct. 2, 1931.

More Figures for Highway Economic Studies

Sir—I was interested in the article by S. B. Folk in *Engineering News-Record*, Aug. 20, p. 310, regarding the cost of operation of automobiles. I have kept very accurate records for the last two years on my car, a model-A Ford coach. During the first year, while the car was new, the item of repairs was small. The total milage traveled was 11,952, which included all kinds of roads in the state of Texas. Two trips were taken during that time, one of 1,100 miles to the Ozarks in Arkansas and a 2,000-mile trip to the lower Rio Grande Valley in Texas.

During the second year the car traveled 11,489 miles, most of which was in Colorado, except 800 miles from Texas to Denver. A long trip was also included in this year's total, a distance of 1,269 miles to the southwest Colorado over all kinds of mountain roads. The maintenance cost ran a little higher that year, which is natural for a car two years old.

The tabulation follows the plan on p. 215, *ENR*, Aug. 6.

Total miles traveled first year, 11,952

Miles per gallon of gasoline	16.8	Gasoline, cents per mile	1.17
Miles per quart of oil	136	Oil, cents per mile	0.23
Gasoline, cents per gallon	19.7	Maintenance, cents per mile	0.27
Oil, cents per quart	30.7		
		Total	1.67

Total miles traveled second year, 11,489

Miles per gallon gasoline	20.5	Gasoline, cents per mile	0.99
Miles per quart of oil	130.5	Oil, cents per mile	0.24
Gasoline, cents per gallon	20.3	Maintenance, cents per mile	0.44
Oil, cents per quart	32.0		0.07
		Total	1.74

RUSSELL D. WELSH.

Denver, Col.,
Sept. 9, 1931.

Radial Brick Stacks—Correction

In the article on waterworks architecture by Victor A. Matteson in our isssue of Sept. 24, 1931, on p. 490 one sentence reads, in part: "A plain radial brick stack cannot be made that is efficient and practical and cheap." The sentence should have read: "A plain radial brick stack *can* be made that is efficient and practical and cheap."

NEWS OF THE WEEK

Engineers Organizing to Promote Employment Programs

State committees of engineers appointed by American Engineering Council now are organizing to carry into effect employment programs to meet the emergency this winter, and also to encourage long-time planning for stabilizing employment. Council's program has been approved by Walter S. Gifford, chairman of the President's Organization for Unemployment Relief, and the state committees of engineers will work with the state organizations set up by the President's organization.

Massachusetts Again Rejects Bid of Out-of-State Firm

The Massachusetts war over the award of highway construction bids was carried still further on Oct. 8 when Gov. Ely's council disapproved the award of a contract to Arute Bros., Inc., of New Britain, Conn., for road construction in Randolph, Mass. The council recommended that the contract be given to the Powers Construction Co., of Brockton, the second low bidder. Lieut. Gov. Youngman dissented from the vote of the council. It was stated afterward that the action of the council was not to be considered a precedent against the award of highway construction projects to out-of-state bidders.

Illinois Highway Work Is Held Up Awaiting High Court Decision

IN A lengthy legal opinion rendered to the Illinois department of public works and buildings as to the effect of the state's prevailing-wage law upon highway contracts, the state attorney-general, Oscar E. Carlstrom, holds that if the state supreme court should sustain the circuit court in finding this law unconstitutional, all contracts entered into under this law will be void. Public officials would then be without authority to issue vouchers or warrants or to pay money from the state treasury on such contracts. Such officers would not be personally liable where they acted in good faith and without notice of the unconstitutionality of their acts, but the circuit court has power to pass upon the constitutionality of legislative acts. Under its decree, therefore, any future action relative to contracts already made, making new contracts on bids already received, or soliciting new bids, would be at the peril of the department and such public officers.

In answer to the question whether it would be legal for the department to advertise for bids on additional new work prior to the final decision of the supreme court, Mr. Carlstrom holds that this action also would be at the peril

(*Continued on page 628*)

OWYHEE DAM MAKES RAPID PROGRESS

Work on this dam for the Owyhee irrigation project in eastern Oregon is here shown as 82 per cent complete. Ultimately the top of the dam will be at the elevation of the roadway parapets shown under construction on the left wall of the canyon, 355 ft. above the bottom of the canyon and 530 ft. above the lowest part of the foundation. Near the center of the picture may be seen the framework for the ring-gate structure of the spillway.

Work Stopped on Construction of Montreal Terminal

Sir Henry Thornton, president of the Canadian National Railways, announces discontinuance for the present of the work on the Montreal terminal plans of the railway. This step was rendered necessary because of the serious decrease in the revenue of the railway and the unsettled state of international financing. Operations will not be summarily stopped, but work will be gradually diminished. The viaduct and some features of the work will be completed.

Engineering Body Reports No Member Out of Work

At a meeting of the council of the New Brunswick branch of the Association of Professional Engineers, held at St. John, N. B., Oct. 2, it was reported that no member of the organization was out of employment. The branch is affiliated with the Engineering Institute of Canada and has been in existence for about twelve years. Membership is held in the branch from every city and town in New Brunswick, and some of the villages.

U. S. Supreme Court to Pass on Validity of Ohio Bond Issues

The Allen County, Ohio, sewer bond case, on which depends the salability and validity of practically all Ohio bond issues for county improvements, is to be carried to the U. S. supreme court. The litigation began when a bondholder attempted to force the Allen County commissioners to levy a general assessment against all property in the county to meet interest payments on bonds which had been defaulted. The taxpayers maintain that the entire county should not be assessed for a sewer project in one community. The litigation has had the effect of making millions of bonds unsalable, and has made it impossible to market bonds for improvements in political subdivisions.

Engineers Report on Construction of Baltimore Airport

W. Watters Pagon and Bancroft Hill, engineers, appointed several weeks ago by Mayor Jackson of Baltimore to make an investigation and report on the advisability of continuing the construction of the Baltimore airport, have reported to the mayor that only by carrying the project through can the city salvage what has been spent. The report states that the airport site is the best available, although the most costly.

$32,000,000 Program in Kansas City to Relieve Unemployment

Definite steps for the first year's expenditures of a $32,000,000 civic program in Kansas City, Mo., are being taken. Three million dollars' worth of public work, especially selected to meet labor employment needs and immediate civic requirements, has been authorized for 1931.

This improvement plan, voted last May for a ten-year period of construction, limits the amount expended per year to $3,200,000. Already expenditure of about $1,300,000 has been authorized and bonds have been sold to cover airport improvements and cost of an auditorium site.

The chief items and their approximate cost of the remaining 1931 works are: water mains, $480,000; trafficways, $350,000; park improvements, $300,000; sewers, $400,000, and excavating for auditorium, $150,000.

Michigan Plans Winter Road Work to Help Idle

Michigan plans an immediate start on a $10,000,000 highway program designed to give employment to 30,000 heads of families during the winter and the program has been approved by the state administrative board. This year's money has been spent and Grover C. Dillman, state highway commisisoner, predicts a deficit of $437,000 by the end of the year.

The plan is to spend most of next year's money before it has been collected. Gov. Bruckner has announced that the banks are ready to finance the proposed operations. The contractor will do his work and submit bills to the state. These will be certified and the contractor will sell them to a bank, which, in turn, will collect from the state as the gasoline tax and automobile weight tax pour money into the highway fund.

Los Angeles Utility to Build New $3,500,000 Unit

Plans for the installation of a 50,000-hp. generating unit in the Seal Beach, Calif., steam-electric plant of the Los Angeles Gas & Electric Corp. have been announced by Addison B. Day, president and general manager of the corporation. The new unit, to be built at a cost of $3,500,000, will bring the capacity of the station to 148,000 hp. Mr. Day announces that work on the addition will be started about Jan. 1.

Work to be done in connection with installation of the new generating unit includes the construction of a 117x168-ft. addition to the present Seal Beach station building to house the unit, construction of a new transmission line from the station to the corporation's Eastside substation in Los Angeles, and the necessary enlargement of this substation to care for the new high-voltage line and the additional load.

Illinois Highway Work Held Up

(Continued from page 627)

of the officers, who might be held personally liable for damages. There is no way of letting contracts for state highways except by competitive bids, and until the constitutionality of the law is finally determined it cannot be known whether the compulsory payment of not less than the prevailing rate of wage is to be one of the necessary elements to be considered in making up such bids. Mr. Carlstrom sums up the situation by saying, "It seems that there is no way of making contracts for state highway construction, with any assurance of their validity, until the constitutionality of this act shall be settled."

As a result of the attorney-general's opinion, all contracts for state highway and building work affected by the law, said to total about $4,000,000, have been canceled by H. H. Cleaveland, director of the department of public works and buildings, and Frank T. Sheets, state highway engineer. Further bids and contracts must await the final decision of the supreme court.

Acetylene Association to Meet in Chicago

The 32d annual convention of the International Acetylene Association will be held at the Congress Hotel Chicago, Nov. 11, 12 and 13. Some of the subjects scheduled for discussion, which will be open to all in attendance, are welding and industry in 1932, training welders and testing welds, welding in the transportation industries, welded piping and pipe lines, welding in the chemical industry, and education in welding.

New Jurisdictional Disputes Loom Among Building Trades

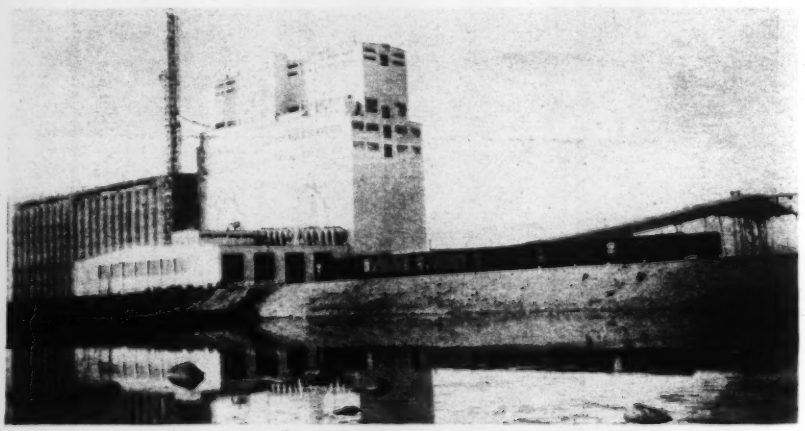
Nationwide obstruction of buildi operations by striking unions is foresee as a possible eventuality from t strained relationship now existing b tween two factions of the America Federation of Labor. In its annual co vention meeting at Vancouver, B. C the matter of jurisdictional rights the unions involved was brought to head.

Bricklayers, carpenters and electri cians, although affiliated with th A. F. of L., are not members its building trades department. Iron workers, elevator constructors and othe members of the building trades depart ment complain that the carpenters an some other craftsmen are taking part of the work not belonging to them Installation of metal frames is one the many sore spots in the situation both carpenters and metal worker claiming the work.

The crafts in the building trades de partment are said to be contemplating strikes on jobs where they think their jurisdiction is violated.

Purdue Announces 7th Annual Conference on Welding

The engineering extension department of Purdue University announces the seventh annual conference on welding to be held at Lafayette, Ind., on Dec. 10 and 11. The meeting will consist of lectures, demonstrations and exhibits. At last year's conference there were 275 representatives of industries of Indiana and neighboring states.



NEW GRAIN TERMINAL IN THE FAR NORTH

The first shipment of 540,000 bu. of wheat has been made from the Canadian government's new grain port at Churchill on Hudson Bay. This picture shows the 2,500,000-bu. grain elevator at the northern terminal of the Hudson Bay Railway. In addition to the grain elevator and railway yards the government is dredging the harbor and building a wharf with a berthing length of 1,854 ft., sufficient for four ships. The port of Churchill on Hudson Bay is about the same distance from the grain-growing regions of the prairie provinces as is Fort William, the grain port at the head of the Great Lakes, and is as near Europe as is Montreal, at the head of navigation on the St. Lawrence River.

Bascule to Replace Old Lift Bridge Over Chicago River

The noted 37-year-old lift bridge carrying Halsted St. over the south branch of the Chicago River is to give place to a trunnion bascule bridge of the type now in general use along the river. An old swing bridge at Halsted St. was damaged by a steamer in 1892; it was replaced in 1894 by a lift bridge, designed by J. A. L. Waddell and then very novel in type. That bridge, described in *Engineering News* of April 19, 1894, p. 320, has 138-ft. trusses (clear opening of 130 ft.) operating between steel towers 215 ft. high (maximum headroom when raised, 155 ft.). Each end is carried by sixteen cables 1½ in. in diameter, which pass over sheaves on the towers and are attached to counterweights. Its designed speed of operation was 240 ft. per minute. When the cables were renewed after 28 years' service, they were found in good condition except where attached to the top chords of the trusses by looping around pins, the looped parts having about half of the strands broken. The bridge has become too light for present traffic and loads. The bascule bridge to replace it will be built through a bond issue of $1,500,000. A temporary structure is being built prior to the removal of the old bridge.

Mid-Hudson Bridge Returns Profit in First Year

During the first year of its operation, the Mid-Hudson Bridge, at Poughkeepsie, returned a net profit of $142,086, Frederick Stuart Greene, superintendent of public works, reports. The first year of traffic over the bridge ended at midnight, Aug. 25. During the year a total of 461,960 vehicles passed over it, and the total receipts were $426,834. The cost of maintenance and operation came to $44,748, leaving a gross profit of $382,086.

Hoover Dam Notes

Use of steel instead of concrete for the bulkheads at the inlets of the outer diversion tunnels at Hoover Dam is under consideration. In designing the outlet works particular attention is being concentrated on the location of the towers in connection with the rock formation. Studies are in progress on the drainage of the canyon wall near the pressure tunnels. The designs for the permanent movable emergency gates at the inlet ends of the 11-ft. penstocks are under way. It is proposed to have one gate for each set of four penstocks.

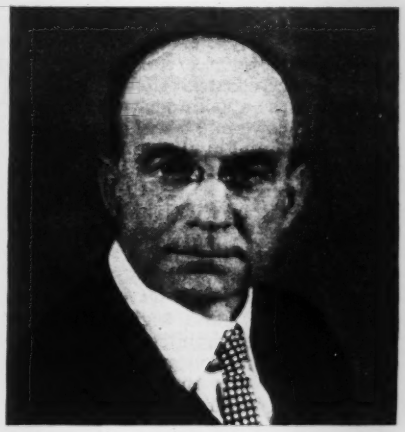
During the week ended Oct. 3 the pioneer headings on the inner Nevada diversion tunnel were holed through between the adit and lower portal. Similar headings were holed through on the inner Arizona tunnel some weeks ago. Enlargement of these two tunnels at the lower portals was begun last week. At the lower portal of the outer Arizona tunnel an experiment in carrying a 36-ft. top heading instead of a 12x12-ft. pioneer tunnel is under way, progressing to date for a distance of 65 ft. Steady progress was maintained in driving pioneer tunnel headings in all the diversion tunnels, a total of 708 ft. being driven during the week.

At Boulder City the main sewer line was placed in service. About 3,000 ft. of sewer pipes and 2,000 ft. of water lines were laid last week.

During the week 200 employees were added to the force. With the advent of cooler weather working conditions are much improved. A fall of rock in connection with canyon wall stripping on the Arizona side resulted in one death.

A. J. Wiley, Consultant on Hoover Dam, Dies

Andrew J. Wiley of Boise, Idaho, consultant for the Hoover Dam project and the Colorado River aqueduct project of the Metropolitan Water District



A. J. Wiley

of Southern California, died on Oct. 8 at Monrovia, Calif. He was 69 years of age. His physician said death was caused by a cerebral hemorrhage. Mr. Wiley was brought to a Monrovia hospital Oct. 7 from the near-by San Gabriel Canyon, where he had gone with a party of engineers to inspect preliminary work being done on a Los Angeles county flood-control project.

Mr. Wiley was identified with many large engineering projects both in the United States and abroad. His first work following graduation from Delaware College in 1882 was with the Idaho Mining & Irrigation Co. in the construction of an irrigation system. He later was the engineer for a number of power projects in Idaho and Wyoming. He designed the Don Pedro Dam and irrigation system for Turlock and Modesto, Calif., and was consulting engineer for a number of other water and power projects in central California. He was consulting engineer for the British government in India in 1927 and 1928 and was engaged as consultant for the Hoover Dam in 1929.

Los Angeles to Extend Water Supply in the Mono Basin

Condemnation proceedings entailing expenditure of $7,000,000 for the acquisition of land and water rights in the Mono Basin of California as an addition to the Sierra Nevada mountain water supply of the city of Los Angeles were authorized by the Los Angeles city council in an ordinance adopted Oct. 6. Funds for the purchases will come from a $38,000,000 water bond issue voted in 1930.

Suits against 167 defendants, including the Southern Sierras Power Co., will be started immediately. The proceedings involve about 150,000 acres of land around Mono Lake, in Mono County, and several creeks that flow into the lake.

The water eventually will be diverted from the Mono watershed to the Owens River valley watershed, where it will be run into the Los Angeles aqueduct system. Construction of a 12-mile tunnel through Dead Man's divide, a gigantic lava flow, will be a major part of the project.

Would Extend Registration of Engineers in Canada

The Ontario Association of Professional Engineers will apply to the Ontario legislature for legislation to place the engineering profession on the same basis in Ontario as it is in the other provinces in the dominion. All the other provinces have registration of engineers, placing the requirements for qualification in the hands of the profession. When all the provinces have the same legislation, it is proposed to form a federal council of examiners, engineers who passed the examination to be permitted to practice anywhere in Canada, without having to go before the provincial boards.

One of Fort Worth, Tex., Reservoirs Nearing Completion

The dam on the Trinity River near Bridgeport, Tex., which the city of Fort Worth has constructed to create a large storage reservoir as a part of its new water-supply system, is receiving the finishing touches and will soon be turned over to the municipality by the McKenzie-Uvalde Construction Co. and the Trinity Farms Construction Co., the joint contractors. This dam is 1,780 ft. long and 115 ft. high, the capacity of the storage reservoir which it forms being 870,000 acre-ft. The same contractors are building a second dam at Eagle Lake, in Tarrant County, for Fort Worth's water-supply system. The latter structure will be 4,200 ft. long and 86 ft. high. The cost of the two dams, together with pipe lines and pumping equipment, will be about $6,000,000, derived from proceeds of a bond issue of $6,500,000. The two lakes formed by the dams will also be used as recreation areas.

Six Bidders for Boston Airport Expansion Project

The Boston Park Commission on Oct. 7 opened bids for the Boston airport expansion project. They were: R. C. Huffman & Co., Cleveland (low bidder), $490,500; Bay State Dredging Co., Boston, $750,025; Coleman Bros., Boston, $796,850; Central Dredging Co., Chicago, $869,000; Trimont Dredging Co., $871,250; A. S. Tomasello & Sons, Inc., Boston, $911,575.

The projected airport extension includes the reclamation of 220 acres of flats adjoining the airport in East Boston. Work is expected to start some time in November.

States Allotted Funds From National Forest Receipts

Federal funds amounting to $1,240,608.99 will be available to 32 states and territories from the receipts of the national forests for the fiscal year 1931. The apportionment, as required by law, is 25 per cent of the net receipts. Payments received by the states will be turned over to the counties containing national forest lands, to be used for roads and schools. The funds are allotted in proportion to the receipts realized from the national forests within each state and represent a federal payment in lieu of taxes on the national forest land.

Farmer Wins Suit for Riparian Rights in Hat Creek, Calif.

On Sept. 30 a decision was handed down in the California supreme court in favor of Louis P. Joerger, a farmer with land riparian to Hat Creek, Calif., by which is made permanent a temporary injunction which the Shasta County superior court had granted on Feb. 6, 1931, restraining the Pacific Gas & Electric Co. from diverting water from Hat Creek. The company had been using the water in the operation of its Hat Creek power house No. 2, which has been inoperative since the granting of the temporary injunction.

Mr. Joerger has been engaged in litigation with the power company over the diversion of the Hat Creek water for about eight years. The litigation was brought to the attention of the general public on Nov. 10, 1930, when Mr. Joerger dynamited a small wooden dam on Hat Creek. The power company obtained an injunction restraining Mr. Joerger from further molesting the dam and sued him for $9,367 damages. In turn Mr. Joerger applied for the injunction to prohibit the power company from further interference in any way with the Hat Creek waters. That injunction is the one just made permanent.

The outcome of the other litigation was the dissolution of the injunction against Mr. Joerger and the rejection of the company's claim for damages.

Wisconsin State Board of Examiners Appointed

A. J. Altmeyer, secretary of the Wisconsin State Industrial Commission, has announced the appointment of six members of the new state board of examiners of architects and civil engineers, as follows: J. J. Flad, Madison; H. A. Fuller, Green Bay; G. J. De Gelleke, Milwaukee; Robert C. Johnson, Fond du Lac; James L. Ferebee, Milwaukee; Prof. F. L. Van Hagan, college of engineering, University of Wisconsin. Three members will serve ex officio, C. A. Halbert, state engineer; Arthur Peabody, state architect, and F. E. Turneaure, dean, college of engineering, University of Wisconsin.

The new board, replacing the previous board of architects examiners, will enforce the law requiring all civil engineers and architects to be licensed in Wisconsin.

NEW QUAYWALL AT ROTTERDAM

A quaywall of concrete is being built in the harbor of Rotterdam. Large precast concrete caissons are floated to the place where the wall is to be erected and then are lowered by weighting them with poured concrete.

Christian Science Publishing Co. to Erect New Building

The largest building wrecking undertaking in the history of Boston has just been started by the Aberthaw Company on the site upon which will be erected the new plant of the Christian Science Publishing Co. The area comprises 1½ acres of ground, bounded by Massachusetts Ave., Norway and Clearway Sts., and 46 brick dwellings and one seven-story brick office building are to be torn down.

Dearborn Plant to Treat Part of Detroit's Sewage

The common council of Detroit, Mich., has authorized Joseph E. Mills, commissioner of public works, to enter into a contract with the city of Dearborn for the treatment of all sanitary sewage collected by the Southfield Road sewer, which serves about 33 square miles in northwest Detroit. The sewage will be treated at the new sewage-disposal plant constructed by Dearborn. This contract will make it unnecessary for Detroit to continue the Southfield Road drain through to the Detroit River, the cost of which has been estimated at $1,000,000.

Universal Atlas Cement Co. Has 9 Months No-Accident Record

Plants of the Universal Atlas Cement Co. at Northampton, Pa., Leeds, Ala., and Independence, Kan., have gone through the first nine months of 1931 without a lost-time accident, according to Gordon C. Huth, safety director of the company. Mr. Huth also reports that the Hannibal Connecting Railroad, a Universal Atlas property, has gone without an accident since July, 1929.

Public Bond Sale Record

Public bonds sold in the first eight months of this year totaled 1,010 millions for long term issues, against 938 millions in 1930 and 827 in 1929. Long and short term issues together totaled 1,513 millions, compared with 1,559 in 1930, and as follows for the five years 1929-25: 1,477; 1,452; 1,428; 1,386; 1,477.

Concrete Pavement Yardage

There is given below a tabulation of concrete pavement yardage awarded in the United States during the month of September, divided according to roads, streets and alleys, and the totals for the eight months' period ended Sept. 3:

	During September	To Oct. 3
Roads	6,182,115	101,596,882
Streets	2,443,639	18,477,352
Alleys	76,431	680,251
Total	8,702,185	120,754,485

Brief News

ERECTION OF A POWER DAM at La Joie Falls on Bridge River in British Columbia is planned by the Bridge River Power Co., a subsidiary of the British Columbia Electric Railway Co., and Branlorne Mines, Ltd., which have applied to the provincial water board for a permit.

CONTRACTS for the construction of the Sorel Bridge over the Richelieu River have been let by the Quebec government. The contract for the superstructure has been awarded to the Dominion Bridge Co., of Montreal, at $318,000, and that for the approaches and other work has been awarded to the Church Ross Co., of Montreal, at $196,041.

A NEW POST OFFICE is projected at Montreal, it is officially announced by the Dominion of Canada public works department, and as soon as plans are completed bids will be called for. The estimated cost of the building is $1,500,000.

THE PROPERTY and system of the Scituate Water Co. has been bought by the town of Scituate, Mass., for $748,813. The purchase, which was authorized by vote of the town, was incited by the threat of the company to raise water rates.

EXPENDITURE of $2,539,000 for drainage work in Dallas, Tex., delayed for several months while various plans were considered, has been authorized by the city council by unanimous vote. Bids will be advertised for immediately.

THE CONTRACT for clearing the site of the new federal building at Texarkana has been let, and the bid for the construction of the building will be awarded about Dec. 1. An unusual feature of the new building will be twin quarters for the Texas and Arkansas federal courts, separated on the state line by a solid fire wall. An appropriation of $790,000 has been made for the building, which will house the post office, federal courts and other governmental offices.

LOUISIANA now has 3,000 miles of paving under contract, it is reported by Chairman Allen of the state highway commission. Of this total, 2,065 miles are concrete and 928 miles asphaltic surfaced. A total of $50,000,000 worth of road and bridge work is now under contract in the state.

EXTENSION of time to Dec. 31 has been granted the Canadian Pacific Railway Co. for completion of its railway tunnel under the city of Vancouver, B. C., and engineers believe that at that time a further extension will be necessary.

CONTRACT for the new office building of the U. S. engineers at Memphis, Tenn., has been officially awarded to J. H. Reddick, of Fort Smith, Ark., on his low bid of $132,810. According to the contract the building must be completed within 120 calendar days.

Water Conservation Dam to Be Built Near Jamestown, Pa.

The Pennsylvania department of forestry and streams has awarded to C. R. Cummins, Inc., of Cleveland, an affiliate of Ulen & Co., a contract for the construction of a dam on the Shenango River near Jamestown, Pa. The dam will be for conservation purposes and when completed will form a lake 25 miles square. It will be a rolled embankment earth dam with a core wall of sheet steelpiling and spillways and conduits of concrete, and will be 2,500 ft. long and 50 ft. high. The contract calls for an expenditure of $340,000.

WASHINGTON NOTES

By PAUL WOOTON
Washington Correspondent

St. Lawrence Waterway Treaty Under Negotiation — Highway Contracts to State Minimum Wage

FORMAL announcement has been made by the state department that, agreeable to the request of the Canadian government, the treaty on construction of the St. Lawrence waterway would be negotiated directly by the ministers of the two countries. Little significance is attached to this formal statement inasmuch as negotiations have been proceeding in this fashion for several months. The state department's announcement evidently was prompted by a letter from Frank P. Walsh, chairman of the New York Power Authority, renewing his request for a conference to discuss the respective interests of the state and federal government in the project before negotiations are entered into with Canada. Mr. Walsh's first letter, written July 25, drew a reply to the effect that "an international agreement must be entered into between the United States and Canada before any steps can be taken in the matter you discussed." No replies, according to Mr. Walsh, have been received to subsequent inquiries made by him on Aug. 1 and by Gov. Roosevelt on Aug. 11. In his last letter, dated Oct. 3, Mr. Walsh states:

"Throughout the summer, however, newspaper articles appeared under Washington date lines, stating, among other things, that informal negotiations with Canada were under way; that other issues than those involved in the joint settlement of the International Rapids section of the St. Lawrence River were to be included in discussions between U. S. government and Canada which would delay the project indefinitely.

"That engineers representing U. S. government had agreed to a project materially differing from that recommended to the State of New York by the board of engineers headed by Major Gen. Edgar Jadwin; and that United States government would take upon itself the St. Lawrence development, burdening the electric power produced with the entire cost of the navigating features.

"While we are loath to take cognizance of such reports, nevertheless in the absence of official information we feel that we would not be discharging our duty to the State of New York if we did not again urge the vital necessity of an early conference to clarify the situation."

Minimum Wage Restrictions in Highway Contracts

In response to protests concerning reductions in wages on federal-aid highway projects, the Bureau of Public Roads has announced its intention of permitting minimum wage rates to be written into future highway contracts. It will be left to the option of the various states whether or not they desire to incorporate such a provision in their contracts involving work on federal-aid highways. In some cases existing state laws will prohibit fixing wages in this manner. As it is now, however, the states cannot specify minimum rates of pay.

Certain restrictions will be insisted upon by the Bureau of Public Roads in permitting the states to regulate wages. In the first place, only the wage rates of unskilled labor will be involved. It is stated in this connection that the majority of the workers on highway jobs fall under this classification and that the skilled workers are not so much at the mercy of wage-cutting contractors. Another condition is that there must be recognition given to fair differentials existing between the various sections and communities of a state.

It is not the intention of Thomas H. MacDonald, chief of the bureau, to make this a permanent policy. He thinks that it is necessary merely to provide some safeguard for labor during the depression.

As the specifications for the work will state the minimum wage scale for unskilled labor, those who submit bids will be working under no misunderstanding concerning the matter. Records kept by the bureau show present and previous wage scales on federal-aid projects. This will permit the bureau officials to determine if the wage levels fixed by the states are reasonable.

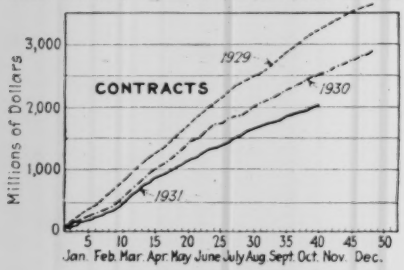
Planning Work for the Future

With all the attention they are giving to the immediate problem, federal bureaus dealing with construction are finding time to plan work for future years, D. H. Sawyer, head of the Federal Employment Stabilization Board, reports. The board is furnishing statistics and other information to state and municipal authorities which show the advantage of the advance planning of public works. A number of states and cities adready have made progress in that direction. In other instances the local authorities are showing a disposition to wait for the federal government to do something.

Capital and Contracts

No new capital for purposes of construction were issued in the week of Oct. 10. A single issue of debentures, however, amounting to $12,000,000, was floated for the Federal Intermediate Credit Bank.

Thus far this month $23,000,000 has been issued, against $16,000,000 in the



first two weeks of September. The average week for October, 1930, was $78,000,000.

Cumulatively, the total to Oct. 10, inclusive, is $2,839,000,000, compared with $5,366,000,000 for the period Jan. 1 to Oct. 11, 1930.

Bids Opened for Test Borings on San Francisco-Oakland Bridge

Bids for drilling of test borings to determine the pier foundation locations for the San Francisco-Oakland bridge were opened on Oct. 7. The Duncanson-Harrelson Co., San Francisco, was low bidder at $63,600. The other bidders were the Healy-Tibbitts Construction Co., $72,800, and the San Francisco Bridge Co., $104,595.

The contract calls for 1,550 ft. of diamond drill holes, 5,000 ft. of jet holes, 3,300 ft. of dry sample borings and driving and loading twelve test piles, the work to be completed within 90 working days.

COSTS AND CONTRACTS

ENR Index Numbers

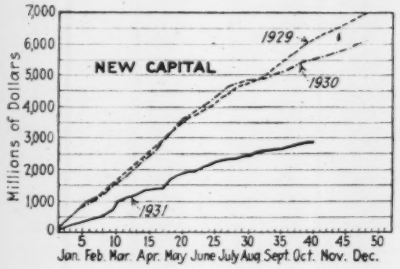
Cost			Volume		
Oct. 1, 1931	169.78	Sept.,	1931	225
Sept. 1, 1931	171.40	August,	1931	187
Oct. 1, 1930	198.72	Sept.,	1930	232
Average, 1930	202.85	Average,	1930	260
Average, 1929	207.02	Average,	1929	317
1913	100.00	1913		100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Oct. 15, with some comparisons, total as follows:

(In Thousands of Dollars)

	Oct. 15, 1931	Average of Last Four Weeks 1931	1930
Buildings:			
Industrial	$4,565	$4,883	$4,763
Other	10,874	11,077	21,822
Streets and roads.	5,908	7,091	9,997
Other construction.	11,686	15,507	9,224
Total	$33,033	$38,559	$45,808
Total, all classes, Jan. 1 to Oct. 15:			
1931			$2,079,636
1930			2,707,159



SOCIETY CALENDAR

AMERICAN INSTITUTE OF STEEL CONSTRUCTION New York City; annual meeting, White Sulphur Springs, W. Va., Oct. 28-30.

AMERICAN SOCIETY OF MUNICIPAL ENGINEERS, St. Louis; meeting, Oct. 19-26, Pittsburgh.

ASSOCIATION OF WESTERN STATE ENGINEERS, fourth annual conference, Sacramento, Calif., Oct. 28-30.

NATIONAL MUNICIPAL LEAGUE, New York City; annual meeting, Nov. 9-11, Buffalo, N. Y.

AMERICAN ROAD BUILDERS' ASSOCIATION has received official nominations from the nominating committee for officers for 1932-33, as follows: president, T. H. Cutler, Jefferson City, Mo.; vice-presidents, A. L. Benedict, Pittsburgh, Pa.; J. W. Barnett, Atlanta, Ga.; Grover C. Dillman, Lansing, Mich.; Stanley Abel, Taft, Calif.; treasurer, James H. MacDonald, New Haven, Conn.

ATLANTIC DEEPER WATERWAYS ASSOCIATION at its annual convention in Boston Oct. 9 elected J. Hampton Moore, former mayor of Philadelphia, president for his 25th successive term. Frank S. Davis, of Boston, was reelected vice-president. The 1932 convention will be held in Hollywood, Fla.

INTERNATIONAL ASSOCIATION FOR BRIDGE AND STRUCTURAL ENGINEERING expects to hold its next congress in Paris, May 19-24, 1932. The subjects now listed for discussion are: stability and strength of structural members subjected to compression and bending; slabs in reinforced-concrete structures; welding in steel structural work; large girder bridges in reinforced concrete; dynamics of bridges; development of the statics of reinforced concrete with regard to the properties of the material used; girders in conjunction with concrete; research concerning building ground.

MASSACHUSETTS FEDERATION OF PLANNING BOARDS met in Lowell on Oct. 7, with more than 100 in attendance. Delegates were present representing the governors of Maine, New Hampshire, Massachusetts, Rhode Island and Connecticut. A city planning forum was held during which delegates discussed planning and zoning problems. W. Franklin Burnham was reelected chairman of the federation.

MONTANA SOCIETY OF ENGINEERS held its 44th annual convention in Butte Oct. 2-3 and elected officers as follows: president, Frank Scotten, Great Falls; first vice-president, Morgan H. Wright, Butte; second vice-president, A. E. Blair, Butte; treasurer, A. E. Adam, Butte; secretary, Lloyd G. Gage, Butte.

SANITARY GROUP, Los Angeles Section, American Society of Civil Engineers, on the resumption of its meetings on Sept. 30 listened to a short talk by Dr. Baker, chief chemist, Wallace & Tiernan Co., on recent experiments by that company in the development of new equipment. Talks were also made by W. A. Allen, assistant operator, Pasadena sewage-treatment plant, and by R. F. Goudey, sanitary engineer, department of water and power, city of Los Angeles, on Eastern plants which they visited during trips last summer.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION has accepted an invitation to hold its 1932 meeting, in July, at the Oregon State College.

Personal Notes

EDWIN M. CHANCE has been advanced from the position of vice-president to president of United Engineers & Constructors, Inc., in which company is coordinated the activities of the U. G. I. Contracting Co., the Day & Zimmermann Engineering & Construction Co. and Dwight P. Robinson & Co. Dwight P. Robinson has retired as president of the combined companies but will continue connection with it in an advisory capacity.

JOHN NOLEN, JR., city planner of the Regional Planning Federation of the Philadelphia Tri-State District, has been appointed city planner of the National Capital Park and Planning Commission in Washington. Mr. Nolen stood first on the list in the recent civil service examination. He succeeds Charles W. Eliot, 2d, who has been advanced to the status of director of planning.

CHAD F. CALHOUN has resigned as chief engineer and general manager of Fisher, Ross, MacDonald & Kahn, Inc., Los Angeles office, and is now working directly with and for Henry J. Kaiser, chairman of the executive committee, Six Companies, Inc. He is now located in Oakland, Calif.

R. H. STERZIK, formerly city engineer of Haynes City, Fla., has been appointed assistant engineer in charge of flowage, U. S. Engineer Office, on the new dams being constructed on the Kanawha River at Charleston, W. Va.

Obituary

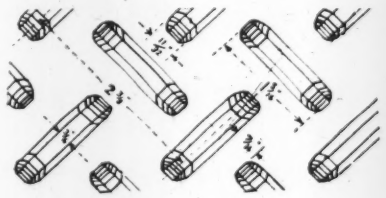
THEO. H. M. CRAMPTON died suddenly at the home of his mother in Santa Monica, Calif., on Sept. 30. Mr. Crampton, who was born in New York City in 1890, had devoted much time to invention, having developed high-temperature furnaces and preformed asphalt-saturated felt planks as a wearing surface for bridge floors. He was among the first to introduce the use of treated diatomaceous earth as an admixture with concrete, especially for road construction. Since 1923 Mr. Crampton had devoted his time largely to road, bridge and railroad work, having been field engineer for the Philip Carey Co. of Cincinnati, vice-president and field engineer for the Universal Asphalt Plank Co., and chief engineer for the Servicized Products Corporation of Chicago. For five years past he had been the supervising engineer of the concrete products section of the Johns Manville Corporation, which firm he had left in June of this year to enter private engineering practice.

FREDERICK W. HOLT died at St. John, N. B., on Sept. 30, at the age of 79. Mr. Holt was born at Hampton, Me., and was graduated from Bowdoin College. He had done much railway engineering work in Maine and New Brunswick.

Construction Equipment and Materials

New Floor-Plate Design

Production of a new four-way floor plate, the pattern of which consists of short linear projections arranged alternately at right angles to each other, has been started by the Inland Steel Co., Chicago, Ill. This pattern permits less

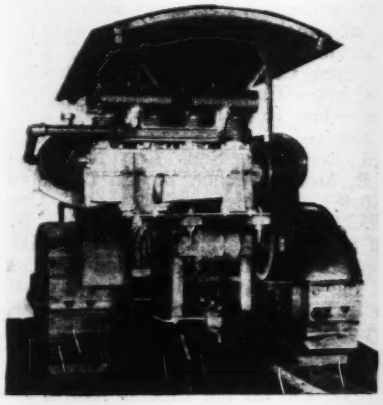


Four-way floor plate

weight per square foot without loss of strength because there is less weight in the projections. It is said to be nonskid regardless of the direction of traffic, and individual plates can be laid in any relation to one another without altering the design. The pattern also assures efficient drainage and easy sweeping.

310-Cu.ft. Air Compressor Attached to Tractor Frame

Use of a 310-cu.ft. portable air compressor without the attendant disadvantages of a separate trailer mounting is made possible by the latest development of the Davey Compressor Co., Inc., Kent, Ohio, which has announced a direct mounting for this unit on the Caterpillar 60 tractor. The compressor unit is the regular 310-cu.ft. four-cylinder Davey air-cooled unit. The mounting consists of steel extensions that bolt to the tractor frame at the rear but do not interfere with normal drawbar operation. The light weight of the compressor and mounting, only 1,800 lb., does not interfere with tractor balance. Compressor drive is through five V-belts and the standard Caterpillar power take-off, which embodies a clutch. The cushioning effect of this drive absorbs the pulsating compressor torque and eliminates undue wear or strain on the tractor mechanism. This driving arrangement also permits the compressor to be started or stopped by a slight movement of a conveniently located clutch lever.



Air compressor mounted on tractor

Shielded Arc Electrode Improved

An improved, heavily coated electrode for welding within the shielded arc on mild steel has been introduced by the Lincoln Electric Co., Cleveland, Ohio. Like its predecessor, this electrode will be known commercially as "Fleetweld." Advantages claimed for it include higher ductility of weld metal (20 to 30 per cent elongation in 2 in.); increased tensile strength of coupons (65,000-80,000 lb. per sq.in.); and greater resistance to corrosion.

The shielded arc process utilizes a heavy coating on the outside of an electrode of mild steel of proper specifications. This coating, burning in the arc less rapidly than the electrode melts, forms in effect a crucible around the arc, protecting it for almost its entire length. As the coating burns it gives off an oxidizing gas that prevents oxygen and nitrogen in the ambient atmosphere from reacting with the molten metal. The shielded arc process, eliminating oxides and nitrides in this manner, gives improved ductility, tensile strength and resistance to corrosion.

The new Fleetweld, a shielded arc electrode, requires high welding current and allows welding speeds said to be from two to four times greater than with bare or lightly coated electrodes. The heavy coating is of special composition material and the metal core is drawn to rigid specifications and carefully selected and tested. The new electrode will be produced in diameters from $\frac{1}{8}$ to $\frac{3}{8}$ in. and in two lengths, the standard 14 in. and the special 18 in., popular on pipe lines and wherever extremely high speed is desirable.

Spring Connector for Cordeau

In connecting up Cordeau for firing a number of shots, it has heretofore been necessary to split the end of the branch line for a distance of 6 or 8 in., and then to wind the two halves in opposite directions around the trunk line. This procedure requires considerable time and in case of rain or snow is uncertain because of the possibility of moisture finding its way inside the connection. To obviate this difficulty, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., have developed a Cordeau connector consisting of two parts: a clip made of spring steel, and a special cap of copper which is partly filled with an explosive mixture similar to that in blasting caps. This mixture is held in place by an inner capsule having a small central aperture, as is shown in the illustration.

Cordeau connector

To use the device, the copper cap is dropped through the aperture in the clip and the freshly cut end of the branch Cordeau is inserted in the open end of the cap until it touches the inner capsule, being held in place by crimping. It is then a simple matter to complete the connection by springing the wings of the clip wide enough to admit the trunk line. This makes a waterproof connection that cannot be affected by snow or rain and at the same time requires only a fraction of the time used in the former method.

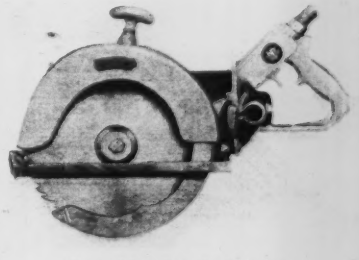
Tin-Plated Rust-Resisting Metal

Possessing the rust- and corrosion-resisting characteristics of copper molybdenum iron, a new product known as Toncan iron tinplate has been announced by the Republic Steel Corp., Youngstown, Ohio. This is said to be the only tinplate with a rust-resisting base on the market today. It can be supplied in all base weights and sizes, and is a suitable material for use in the manufacture of such articles as lanterns, gas meters, soundproof ceilings, gutters, flashing, conductor pipe, and in other architectural and industrial applications.

Light Electric Saw

Wood, stone, slate and other building materials can be cut with a new portable electric hand saw announced by the United States Electrical Tool Co., 2490

(Continued on p. 636)



Portable electric hand saw

Current Construction Unit Prices

Thief Valley Dam in Oregon

THIEF Valley Dam of the Baker project, Oregon, is on Powder River, 7½ miles from North Powder, the nearest railroad station on the Union Pacific. The dam is of the buttressed type, with reinforced-concrete face slabs. It is 380 ft. long at crest, of which 270 ft. is the spillway, and 66 ft. high. The outlet works are two 4½x6-ft. openings near the bottom of the upstream face of the dam. These are protected by trash racks and equipped with cast-iron sliding gates operated by a gasoline engine. Figs. 1 and 2 show the construction of the dam.

	A	B	C
Diversion and care of river during construction and unwatering foundations (lump sum)	$3,500.00	$2,000.00	$2,000.00
7,500 cu.yd. common excav.	0.60	0.50	0.65
500 cu.yd. solid rock excav.	4.00	3.00	4.00
1,750 lin.ft. drilling grout holes	1.00	1.00	1.20
200 cu.ft. pressure grouting	2.00	4.00	2.00
100 cu.yd. backfill	1.00	1.00	1.00
270 cu.yd. conc. in cutoff wall	6.00	8.00	8.05
1,590 cu.yd. conc. in upstream face slab and spillway crest	10.00	11.00	13.50
2,450 cu.yd. conc. in buttresses, buttress footings and gate structure	9.00	11.00	11.35
120 cu.yd. conc. in beams, walkways, parapet walls, floor slabs and struts	20.00	16.00	20.00
275 cu.yd. mass conc. in abutment sections	11.00	8.00	10.00
70 cu.yd. conc. pavement in outlet bays	10.00	8.00	8.70
402,000 lb. placing reinf. bars	.015	.02	.018
3,000 lb. placing grout pipe	.10	.10	.05
22,800 lb. installing and painting slide gates hoists and operating machinery	.10	.05	.04
22,000 lb. installing and painting metal work in trash rack structure	.05	.05	.03
1,800 lb. installing and painting pipe handrail	.10	.05	.06
Totals	$67,835	$71,850	$77,746

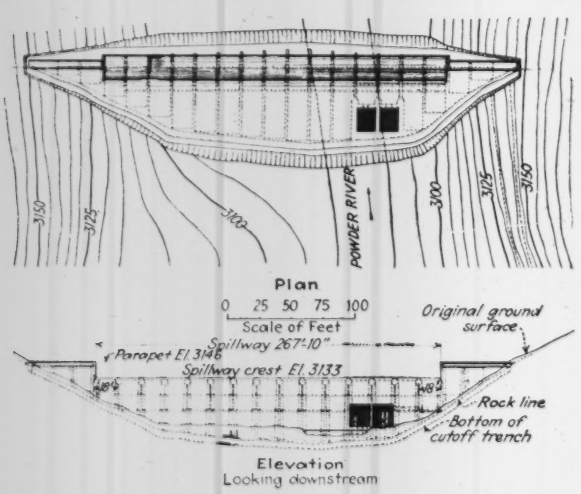


Fig. 1—Plan and elevation of Thief Valley Dam, Oregon

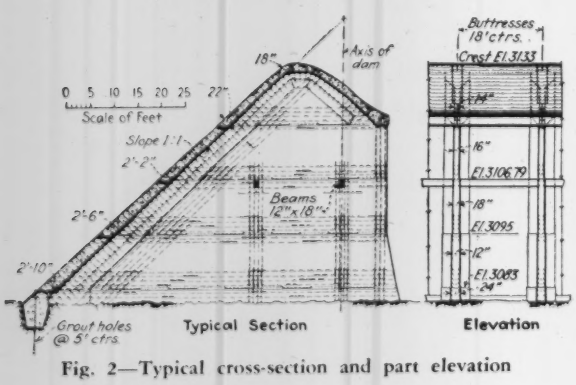


Fig. 2—Typical cross-section and part elevation

Government furnishes f.o.b. North Powder all material forming the completed structure. Contractor furnishes concrete aggregates, forms and other materials of erection.

Contract price is $67,835. The six concrete items total $55,695, exclusive of the $6,030 for reinforcing. Compressive strength varies from 2,000 to 3,000 lb.

Twelve bids were received, averaging $91,400. Unit prices are given of the lowest three: (A) Idaho Contracting Co., Boise, contract; (B) W. H. Puckett Co., Boise; (C) Barnard-Curtiss, Minneapolis. Construction is under supervision of U. S. Reclamation Bureau; Elwood Mead, commissioner.

Sag Harbor and Greenport Highway Suspension Bridges to Shelter Island, N. Y.

TWO high-level suspension bridges, each with 22-ft. roadways and two 2-ft. sidewalks, will be built to Shelter Island, N. Y., from the mainland near Sag Harbor and Greenport. Approaches to each consist of deck plate girder viaducts. The bridges are respectively parts of Suffolk County roads 44 and 45.

The Sag Harbor bridge consists of a 700-ft. main span and two 350-ft. side spans. The north approach consists of 840 ft. of deck plate girder spans and 210 ft. of fill; the south approach of 420 ft. of deck spans and 230 ft. fill. The main towers are 148 ft. high.

The Greenport bridge has a 1,100-ft. main span and two 600-ft. side spans. The north approach consists of 400 ft. of deck truss spans, 960 ft. of deck plate girder spans and 290 ft. of fill; the south approach of 400 ft. of deck truss spans, 360 ft. of deck plate girder spans and 150 ft. fill. The main towers are 245 ft. high.

Foundations for both structures are of concrete, those in water being faced with granite. Borings show the bottom to be sand at the Sag Harbor site and sand and gravel at the Greenport site. Placing will probably be by open cofferdam method.

The Sag Harbor bridge foundations contain 18,395 cu.yd. concrete; the Greenport bridge foundations 36,265 cu.yd. Concrete is Class A and Class B, described below. A is used for roadway, curbs and sidewalks and in the small shafts of the viaduct piers; B is used elsewhere. For tremie concrete the cement content is increased 25 per cent and amounts to not less than 7 bags per cubic yard:

	Class A	Class B
Mix (nominal)	1 : 5½	1 : 6
Bags per cu.yd (minimum)	6.16	5.64
Gal. water per bag concrete (maximum)	6.0	6.5
Compression 7 days	1,750.0	1,600.0
Compression 28 days	3,000.0	2,800.0

Lump sum bids were received for the two substructures and for the two superstructures. Twelve bids were received for the substructures, of which the lowest three were: A, Booth & Flinn, Ltd., Pittsburgh, $889,615, contract; B, Joseph Leopold & Co., New York City, $943,519; C, Foundation Co., New York, $1,092,544. The high bid was $1,381,911; the average of the twelve bids was $1,180,000.

Four bids were received for the superstructures as follows: A, John A. Roebling's Sons Co., New York, $1,299,919, contract; B, Mount Vernon Bridge Co., Mount Vernon, Ohio, $1,316,481; C, McClintic-Marshall Corp., Bethlehem, Pa., $1,432,643; American Bridge Co., New York, $1,495,517 (not tabulated); average bid $1,386,000.

Unit prices for purposes of deductions and additions were requested for each of the substructures and superstructures separately, and these are given herewith for the lowest three bidders. Albert O. Smith is superintendent of highways for Suffolk County, N. Y.; Robinson & Steinman, New York City, are engineers. Bids were opened on the substructures Aug. 11, 1931, and on the superstructures Aug. 31, 1931.

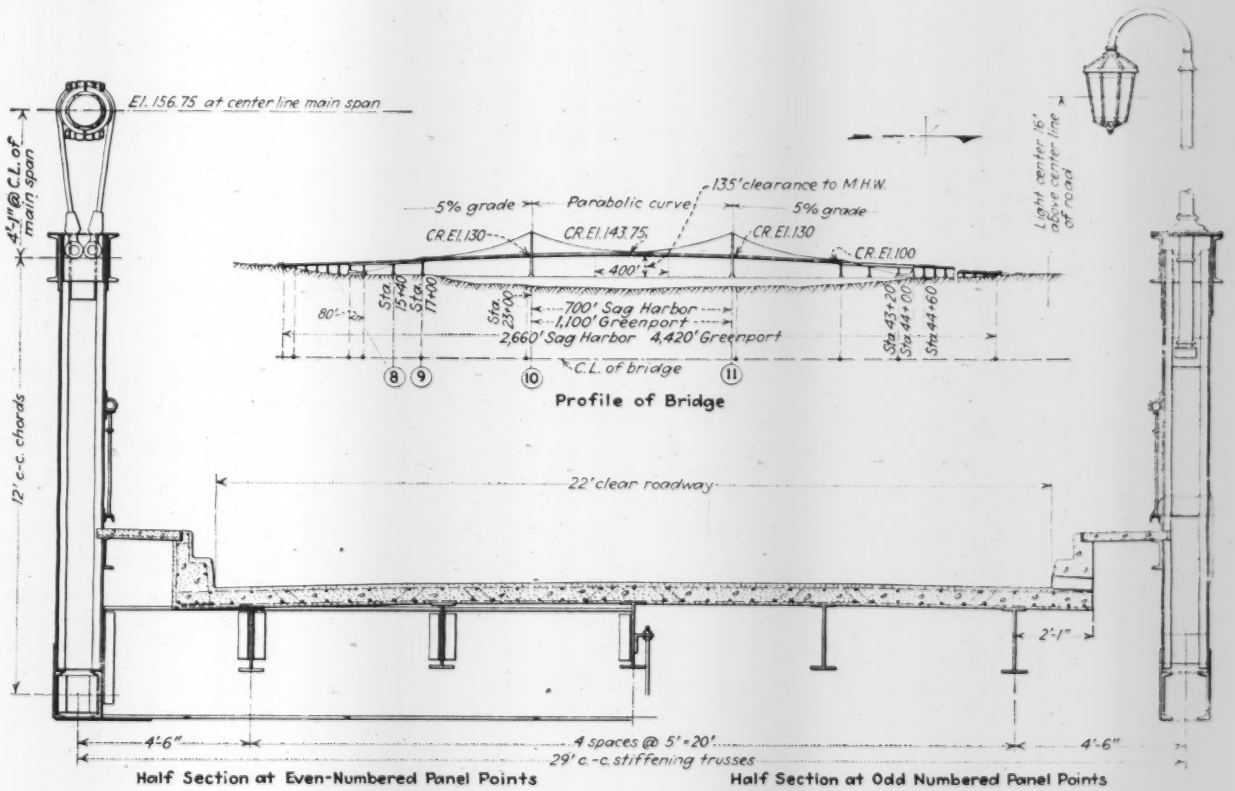
Current Construction Unit Prices

TABLE I—SUBSTRUCTURES

Sag Harbor Bridge:	A	B	C
4,065 cu.yd. earth excav., piers 1-11	$6.50	$2.00	$8.30
6,940 cu.yd. earth excav. anchorages	4.00	1.00	3.00
1,117 cu.yd. earth excav., other piers	4.00	1.00	9.50
3,400 cu.yd. conc. dep. in water, piers 8 and 9	6.50	7.00	10.60
1,957 cu.yd. conc. dep. in water, P. 1,2,3,6,7,10,11	6.50	8.00	10.60
4,110 cu.yd. conc. dep. in water, anchorages	8.00	8.00	10.60
387 cu.yd. conc. ft. piers 14-23	8.00	6.00	11.00
1,344 cu.yd. conc. dep. in dry, piers 8 and 9	6.50	6.00	11.00
328 cu.yd. conc. dep. in dry, prs. 1, 2, 3, 6, 10, 11, 7	9.00	7.00	17.00
597 cu.yd. conc. dep. in dry, anchorages	9.00	7.00	10.00
276 cu.yd. conc. shafts and caps, piers 14-23	14.50	7.00	20.00
618 cu.yd. conc. in abutments	14.00	8.00	27.00
290 cu.yd. granite facing, piers 8 and 9	65.00	50.00	60.00
356 cu.yd. granite facing, anchorages	65.00	50.00	60.00
319 cu.yd. granite facing, p, 1, 2, 3, 6, 7, 10, 11	65.00	50.00	60.00
630 cu.yd. sand fill in anchorages	1.00	.01	.60
8,350 cu.yd. fill in approaches	1.50	.01	.55
10,560 sq.ft. waterproofing	.03	.01	.05
Door in south abutment, 1 each	100.00	100.00	180.00
255,500 lb. reinforcing steel	.03	.05	.06
28,200 lb. anchor bolts and grillages	.06	.07	.09
154,000 lb. anchorage steel for cables	.06	.08	.07
22,100 sq.ft. steel sheet piling left in place	.65	4.00	.58
3,740 ton riprap	4.35	5.00	.00
Greenport Bridge:			
7,740 cu.yd. earth excav. P. 9, 10, 11, 12, 13, 17, 18, 19	$5.00	$2.00	$8.30
12,000 cu.yd. earth excav., anchorages	4.00	1.00	3.00
1,880 cu.yd. earth excav., other piers	5.00	1.00	9.50
10,780 cu.yd. conc. dep. in water, piers 10, 11	6.50	7.00	10.60
3,856 cu.yd. conc. dep. in w., P. 9,12,13,16,17,18,19	6.50	8.00	10.60
6,800 cu.yd. conc. dep. in water, anchorages	8.00	8.00	10.60
780 cu.yd. conc. footings, piers, 1-5, 8, 20-30	8.00	6.00	11.00
2,000 cu.yd. conc. dep. in dry piers 10, 11	6.50	6.00	11.00
422 cu.yd. conc. dep. in dry, p. 9,12,13,16,17,18,19	8.50	7.00	17.00
550 cu.yd. conc. dep. in dry, anchorages	8.50	7.00	11.00
403 cu.yd. conc. shafts and caps, piers 1-5, 8, 20-30	14.00	7.00	20.00
680 cu.yd. conc. in abutments	15.00	8.00	27.00
412 cu.yd. granite facing, piers 10 and 11	65.00	50.00	60.00
505 cu.yd. granite facing, anchorages	65.00	50.00	60.00
390 cu.yd. granite fac., P. 9, 12, 13, 16, 17, 18, 19	65.00	50.00	60.00
2,140 cu.yd. sand fill in anchorages	1.00	.01	.60
9,000 cu.yd. fill in approaches	1.50	.01	.55
14,630 sq.ft. waterproofing	.03	.01	.05
Door in south abutment, 2 each	100.00	100.00	180.00
350,400 lb. reinforcing steel	.03	.05	.06
41,200 lb. anchor bolts and grillages	.06	.07	.09
326,000 lb. anchorage steel for cables	.06	.08	.07
43,800 sq.ft. steel sheetpiling left in place	.65	4.00	.58
4,675 tons riprap	4.35	5.00	3.50

TABLE II—SUPERSTRUCTURES

Sag Harbor Bridge:	A	B	C
910,000 lb. main tower	$0.063	$0.066	$0.0738
125,000 lb. cable bents	.059	.075	.0564
1,700,000 lb. stiffing trusses and fl. sys	.057	.069	.0564
1,090,000 lb. approach girders, bent sys	.040	.060	.0562
73,660 lb. strand plates, shims, bolts	.150	.130	.105
43,000 lb. cast-steel tower and cable bents	.210	.080	.105
37,000 lb. cast-steel cable bands and splay cas	.355	.128	.184
29,000 lb. cast-steel bearing blocks str. sus	.165	.220	.274
650 lb. bronze bearings	.420	.600	.960
6,800 lb. high tension bolts	.195	.120	.1225
2,520 ft. railing on approach	4.150	2.500	5.2004
2,800 ft. railing on suspended spans	2.200	1.820	4.256
Bronze name plates, 2 each	200.00	125.00	175.00
550,000 lb. cable stran	.156	.107	.158
3,185 ft. wood fillers	.965	.600	1.480
41,000 lb. wrapping wire	.345	.130	.100
7,750 ft. suspender rope	.805	.500	.600
5,800 ft. hand rope	.280	.250	.300
Collars at saddles, 16 each	48.000	60.000	45.000
Splay hoods, 4 each	1,375	1,000	1,000
1,690 cu.yd. conc. in roadway curbs and sidewalks	20.000	19.000	23.60
408,000 lb. reinforcing steel	.050	.035	.037
Greenport Bridge:			
2,170,000 lb. main tower	.051	.060	.0706
306,000 lb. cable bents	.046	.0675	.0659
3,220,000 lb. stiffing trusses and fl. sys	.042	.0695	.0561
1,400,000 approach girders, bents fl. sys	.040	.0581	.0554
1,312,000 lb. approach trusses, bents fl. sys	.041	.064	.0656
106,000 lb. strand plates shims, bolts	.139	.138	.0800
58,000 lb. cast steel tower and cable bents	.205	.084	.1050
82,000 lb. cast cable bands and splay sas	.270	.124	.1290
49,000 lb. cast-steel bearing blocks str. sus	.155	.210	.2900
1,000 lb. bronze bearings	.411	.600	.9000
10,200 lb. high tension bolts	.095	.120	.1150
4,240 ft. railing on approach	4.150	2.500	5.2000
4,600 ft. railing on suspended spans	3.440	2.500	4.3600
Bronze name plates, 2 each	200.00	125.00	175.00
1,610,000 lb. cable strand	.140	.100	.1300
5,760 ft. wood fillers	.910	.600	1.4000
95,000 lb. wrapping wire	.235	.085	.0825
15,500 ft. suspended rope	.840	.550	.6250
9,500 ft. hand rope	.255	.250	.2500
Collars at saddles, 16 each	48.000	60.000	48.000
Splay hoods, 4 each	1,375	1,200	1,250
2,805 cu.yd. conc. in roadways, curbs and side	20.00	19.00	23.60
678,000 lb. reinforcing steel	.050	.035	.0370



General design and typical cross-section of Greenport bridge

Light Electric Saw

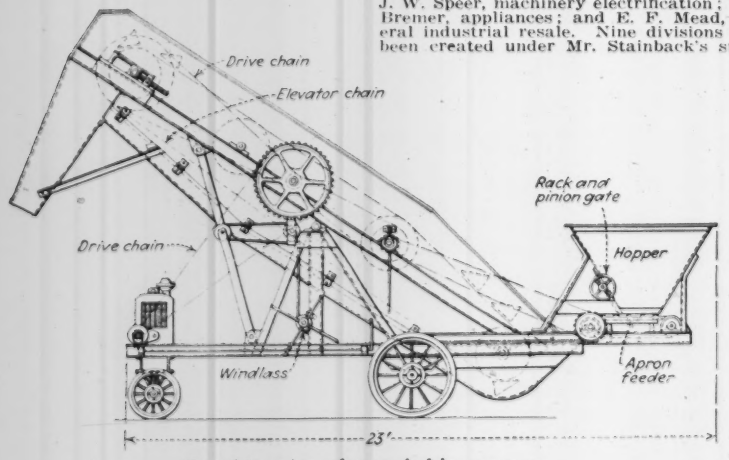
(Continued from p. 633)

West Sixth St., Cincinnati, Ohio. This is made in five sizes, the largest of which will make a maximum cut of 4⅛ in. and weighs only 26¼ lb. Two easy adjustments set the saw quickly for any depth and for any angle to 60 deg. A patented beveling device does away with the need for a try-square. A clear vision blower keeps the sawdust away from the markings, assuring even sawing. Top and automatic bottom guards protect the operator in every working position. Ball bearings are used throughout, and a special heat-treated double reduction gear assures long life and maximum power from the universal motor, which will operate on either alternating or direct current at 110, 220 and 250 volts.

Wheel-Mounted Mixing Plant for Bituminous Paving

The increasing popularity of emulsified asphalts and tars in the manufacturing of bituminous concretes has led to the development by the Asphalt Equipment Co., Scottsdale, Pa., of the Doorley portable emulsified bituminous concrete plant, which mixes and delivers crushed slag, stone or gravel and commercial emulsified bitumens by the immersion method. The product includes practically every type of cold-mix bituminous concrete meeting various state highway specifications. Cold-patch material and chips for surface-treatment work can also be handled.

Details of the machine are shown in the drawing. Material flows from a hopper with a rack-and-pinion feed gate operated by a handwheel over an apron feeder to an elevator of double-strand construction, by which it is elevated to a discharge chute. Power is supplied by a 15-hp. motor, gasoline or electric, equipped with speed reducer and clutch. The entire assembly is supported on a steel truck equipped with 7-in. rubber-tired wheels with roller bearings.



Portable mixer for asphaltic concrete

Business Notes

H. O. Penn Machinery Co., 140th St. and East River, New York City, has appointed Jack Conway manager in charge of sales for the entire line of construction and industrial equipment handled by the company. Prior to his present connection Mr. Conway was sales manager for the Complete Machinery Co., New York City, the Hunter Machinery Co., Pittsburgh, and the Leach Mixer Co., Oshkosh, Wis.

Sullivan Machinery Co., Chicago, Ill., has appointed Leon J. Cone district manager at Duluth, Minn., succeeding Jonathan A. Noyes, who has been promoted to manager of the company's coal machinery sales division, with headquarters at Chicago.

Caterpillar Tractor Co., Peoria, Ill., has created a specialty sales division, the primary purpose of which is to market the company's gasoline and diesel engines to other manufacturers of construction equipment. It will also direct the company's present activities in promoting sales to railways and public utilities. This division is headed by Walter H. Gardner, formerly advertising manager, who is now succeeded by G. M. Walker as advertising manager.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has transferred all tractor sales activities to Milwaukee under W. A. Roberts, general sales manager, who was until recently agricultural sales manager. Products handled by Mr. Roberts include track-type and industrial wheel tractors, farm tractors, farm implements and the Advance-Rumely line of harvesting equipment. H. J. Yoakum, lately district manager of the company's Monarch tractor division in Iowa, Nebraska, Wisconsin and Upper Michigan, now has direct supervision of industrial sales.

Pennsylvania Pump & Compressor Co., Easton, Pa., has formed a connection with Byer Engineering Associates, of the same city, which specializes in condensing and cooling apparatus, vacuum pumps, car-washing apparatus and centrifugal pumps used in connection therewith.

R. V. Donnelly, who some time ago disposed his interests in the old Paradon Mfg. Co. to the Paradon Co., has terminated his connection with the latter organization.

Universal Road Machinery Co., Kingston, N. Y., has acquired the Robert M. Gay Co., New York City, manufacturer of Gayco separators for finely pulverized materials.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has reorganized its industrial sales department according to the main classifications of industry. The reorganized department is under the direction of O. F. Stroman, industrial sales manager. Bernard Lester and C. B. Stainback have been appointed assistant sales managers. Mr. Lester will have general charge of the development of business with industrial users of electrical equipment, while Mr. Stainback will have charge of apparatus applying to these industrial groupings. Under the former there have been created five industrial divisional classifications with the following in charge: G. E. Stoltz, mining and metal working; G. D. Browne, general mill electrification; J. W. Speer, machinery electrification; E. B. Bremer, appliances; and E. F. Mead, general industrial resale. Nine divisions have been created under Mr. Stainback's supervision, headed by: J. R. Olnhausen, medium a.c. motors; R. M. Davis, medium d.c. motors; R. O. Watson, large motors; D. H. Byerly, small motors; W. W. Reddie, welding; T. C. Kelly, industrial heating; W. G. Balph, safety switches; W. H. McGillivray, control; F. W. Horst, cost. J. M. McKibbin, Jr., has been appointed manager of the promotion and advertising section. The company has also announced the advancement of Roscoe Seybold from assistant to the president to comptroller.

National Acme Co., Cleveland, Ohio, and Windsor, Vt., has entered into a license agreement with the Dardelet Threadlock Corp. to manufacture, use and sell bolts, nuts and screw machine products threaded with the Dardelet self-locking screw thread.

American Rolling Mill Co., Middletown, Ohio, has advanced W. W. Sebald from the post of assistant sales manager to assistant vice-president. His new duties will involve special work in connection with the company's sales activities. Mr. Sebald will be succeeded by H. M. Richards, manager of Armco's Cleveland sales district, who will, in turn, be succeeded by Foster E. Wortley, his former assistant.

Ludlow Valve Mfg. Co., Troy, N. Y., will manufacture in Canada as the Canadian Ludlow Valve Mfg. Co., Ltd. Offices are located at 930 Wellington St., Montreal, and factories at Three Rivers, Que., St. Thomas, Ont., and Fort William, Ont.

Barber-Greene Co., Aurora, Ill., announces the appointment as general sales manager of F. D. Hooper, formerly sales manager for the Lidgerwood Mfg. Co.

Lidgerwood Mfg. Co., Elizabeth, N. J., has appointed A. W. Boldebuck sales manager. Mr. Boldebuck was formerly in charge of the company's Chicago office.

Worthington Pump & Machinery Corp., Harrison, N. J., has elected LaMonte J. Belnap chairman of the executive committee. He is succeeded as president by Harry C. Beaver, formerly vice-president.

Massey Concrete Products Corp. has transferred its central district office from Cincinnati, Ohio, to the Midland Bank Building, Cleveland, Ohio. W. Lyle McDaniel is resident manager.

Alexander Mayer, formerly Western representative of Wemlinger, Inc., has opened an office in the Builders Building, Chicago, Ill., for the sale of new and used steel sheet piling.

American Manganese Steel Co., Inc., Chicago Heights, Ill., has appointed W. C. Bruton district sales manager for the Pacific Northwest territory.

R. G. LeTourneau, Inc., Stockton, Calif., announces the appointment of Charles E. Cole as factory representative.

Republic Steel Corp., Youngstown, Ohio, has appointed William T. Bentz manager of sales of rail steel products. He was formerly sales head of Steel & Tubes, Inc., a Republic subsidiary.

Timken Steel & Tube Co., Canton, Ohio, announces the election of F. J. Griffiths as director and president. M. T. Lothrop, who is also president of the Timken Roller Bearing Co., has been made chairman of the board.

International-Stacey Corp., Columbus, Ohio, announces the transfer of C. B. Coldwell from Chicago to the Fort Worth, Tex., office. B. T. Ehrnman has been transferred from Chicago to St. Louis as division manager. A. G. Bradbury, manager of the Michigan division, has transferred his headquarters from Jackson to Detroit.

D. C. Babcock, branch sales manager for the Four Wheel Drive Auto Co. in charge of all factory branches, died Aug. 19 of appendicitis at Wausau, Wis. He was born Oct. 30, 1896, was graduated from Carroll College, Waukesha, and entered the F. W. D. organization in March, 1920.

Wallace McCausland, general manager of sales for the Reading-Pratt & Cady Co., Inc., Bridgeport, Conn., died Sept. 4.

W. P. Mosteller, New England sales representative of the United States Pipe & Foundry Co., died suddenly on Oct. 1 while attending the annual convention of the New England Water Works Association at Boston, Mass. He was born at Gordontown, Ga., Nov. 18, 1876, was educated at local schools and at the University of Georgia, and joined the United States Pipe & Foundry Co. in 1918.

CONSTRUCTION NEWS

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Some of the Week's Large Projects

Location	Project	Cost	Status
Sewers			
Elmira (N. Y.)	Sewage treatment, plant, etc.	$1,000,000	Proposed
Montreal (Que.)	Sewer	2,000,000	Bids asked
Bridge			
Albany	Bridge and grade crossing	3,578,881	Bids asked
Railways			
British Columbia	Railway extension	3,000,000	Day labor
Piers and Wharves			
Gulfport (Miss.)	Pier, warehouse, etc.	1,000,000	Proposed
New York	Pier substructure	6,000,000	Bids asked
Sports and Parks			
New York	Parks and playgrounds	9,000,000	Proposed
Unclassified			
New York	Subway signal system	2,371,800	Contract
Federal Government			
Washington	Senate office	2,197,000	Contract
Washington	Dept. Justice building foundation	949,000	Contract
Miami (Fla.)	Post office	1,032,473	Contract
Cleveland	Post office	5,275,000	Proposed
Buildings			
New York	Apartment	1,000,000	Separate contracts
Gary (Ind.)	School	1,000,000	Contract
Randolph (Mass.)	Church	1,500,000	Proposed
South Hadley (Mass.)	College	2,000,000	Proposed
Factories and Mills			
Alameda (Calif.)	Glass factory	1,000,000	Proposed
Santa Ana (Calif.)	Glass factory	4,000,000	Contract
Duluth (Minn.)	Power plant	1,500,000	Bids asked
Corpus Christi (Tex.)	Chemical plant first unit	10,000,000	Proposed
Texas	Oil refining plant	3,000,000	Proposed

WATERWORKS

PROPOSED WORK

N. J., Asbury Park—City Comn., plans elevated steel water tank and tower, at incinerator in Shrewsbury Twp. E. K. Fowler, city engr.

N. J., Bridgeton — Bd. City Council, City Hall, preliminary plans steel reservoir in 5th ward and constructing wash water tank, low pressure pump at waterworks. $62,700. Address City Engineer.

N. J., Margate City—Bd. City Comrs., City Hall, enlarging, extending waterworks, incl. new mains, appurtenances. $25,000. **Maturity soon.** E. D. Richtmire, city engr.

N. J., Ocean Gate—Mayor and City Council, plans water mains. Engineer not appointed. $15,000.

N. J., Paterson—North Jersey Dist. Water Supply Comn., 156 Ellison St., chlorinating plant, at Peters Mine Brook and Ringwood Brook, Wanaque. $15,000. Fuller & Everett, 25 West 43rd St., New York, engrs.

O., Cleveland—City Council rein.-con., brick, high service reservoir in Wooster Rd. $600,000. H. Kreglius, 504 City Hall, city archt.

Tex., Beaumont—City, c/o P. Millard, water tank, tower. $45,000. R. C. Black, Beaumont, engr.

Ont., Oshawa—Oshawa Public Utilities Comn., City Offices, plans water main extension easterly to Harmony, incl. 3 mi. 6 in. and up, c.i. mains, valves, hydrants, etc., earth excavation, $20,000. F. B. Goedike, City Office's engr.

Ont., Pembroke—Town, waterworks filtration plant, incl., building, filters, valves, piping pumps, etc. $100,000. J. P. Howe, Town Hall, engr. Noted Oct. 1.

Ont., Tecumseh—Town, plans 2 mi. 12 in. c.i. water main incl. valves, manholes, hydrants, etc. $100,000. Newman & Armstrong, Davis Bldg., Windsor, engrs.

BIDS ASKED

Ind., Ft. Wayne—Nov. 3, by Bd. P. Wks., 24 m.g.p.d. filtration and pumping station. Hoad, Decker, Shoecraft & Drury, Ann Harbor, Mich., consult. engrs.

Mass., Cambridge—Oct. 16, by City Council, laying mains in Cambridge, Watertown and Waltham. $15,000. Hazen & Everett, 25 West 43rd St., New York, engrs.

N. J., Holmdel—Oct. 23, by Dpt. Institutions & Agencies, State House, Trenton, water treatment plant, aeration and filtration at New Jersey State Hospital. $15,000 or more. Former bids rejected. Div. Architecture & Constr., State House, Trenton, engr.

N. J., Paterson—See "Contracts Awarded."

N. Y., Brooklyn—Oct. 20, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Floyd Bennett Airport and Barren Island.

N. Y., Long Island City—Oct. 20, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Ellwell Crescent, 154th Dr., Tryon, Tudor and 15th Rds., 71st, 73rd, 74th, 48th and 165th Aves., Alderton, Nansen, 46th, 68th, 73rd, 74th, and 97th Sts., Queens Boro.

R. I., Newport—F. M. Sisson, City Hall, taking bids pumping stations Waterworks Road and Merchant St. $15,000 or more. Private plans.

Tex., Corpus Christi—Oct. 29 (extended date) by City, c/o E. F. Flato, rehabilitation La Fruta Dam on Lake Lovenskiold. $417,000. E. E. Elrod and R. J. Cummins, 1105 Nixon Bldg., Corpus Christi, and 727 Mortgage Bldg., Houston, engrs., L. C. Hill, 605 West 10th St., Los Angeles, Calif., consult. engrs.

CONTRACTS AWARDED

Md., Baltimore—Bd. Awards, excavation, completely installing and backfilling 48 in. suction main for Ashburton Pumping Station, to M. and J. B. McHugh, 3716 Sequoia Ave., $12,717. Noted Sept. 17.

Neb., Lincoln—City Council, 19,645 ft. 24- to 36-in. c.i. well pipe line from city's well to proposed reservoir and pumping station near Ashland, to Williams Bros., Inc., Tulsa Okla., $211,437. Noted Sept. 17.

Neb., North Bend—J. C. Newman, city clk., one 50,000 gal. steel tank on 110 ft. steel tower and taking down old standpipe, to Omaha Steel Wks., 609 South 48th St., Omaha, $6,775 and $350 respectively; 4,680 ft. 4 and 8 in. Universal Class 150 c.i. pipe, to Central Fdry. Co., 332 South Michigan Ave., Chicago, Ill., $3,212; 2 hydrants, three 8 in. and eleven 4 in. valves, boxes, to Crane Co., 323 South 10th St., Omaha, Neb., 836 South Michigan Ave., Chicago, Ill., $386; 16 in. tubular well and one 350 g.p.m. deep well pump and motor, to Layne Western Co., 507 Mutual Bldg., Kansas City, Mo., $2,555; laying 5,780 ft. 4- and 8-in. pipe; removing 1,200 ft. 4 in. old pipe, to T. J. Gaughen Hardware Co., North Bend, $1,834; brick pump house, to E. Eskildsen, North Bend, $1,700. Grand total $16,812. Noted Sept. 14 Daily.

N. J., Paterson—Passaic Valley Water Comn., 156 Ellison St., water pumping station, at Great Notch, separate contracts and day labor, $15,000 or more. Former bids rejected. Fuller & Everett, 25 West 43rd St., New York, engrs. Noted Sept. 28.

SEWERS

PROPOSED WORK

Calif., Los Angeles—Wilmington Intercepting Sewer, Sect. 2. $195,000. J. J. Jessup, city engr.

Calif., Modesto — City Council sewer and water extensions. $40,000. F. J. Rossi, city engr.

Conn., Naugatuck—Town Dpt. P. Wks. plans sewage disposal plant and sewer main. $25,000 or more.

Neb., Lincoln—Preliminary plans Sewer Sect. 1, Washington and 38th Sts., $22,000; Sect. 2, 51st and South Sts., $25,000; Sect. 3, 27th St., $6,000. D. L. Erickson, city engr.

N. J., Hasbrouck Heights—Bd. Boro Council, Municipal Bldg., will not build sewage disposal plant. $25,000. Project abandoned. Noted Aug. 19.

N. J., Somerville—Bd. Boro Council, Boro Hall, 1 story, brick, rein.-con. sewage disposal plant. $25,000. **Maturity probably in January.** Remington, Vosburg & Clark, 509 Cooper St., Camden, engrs. Noted Aug. 13.

N. J., West New York—Bd. Freeholders Hudson Co., Court House, Jersey City, storm sewer in River Rd. and 16th St. $25,000. **Maturity probably soon.** F. J. Radigan, Jersey City, co. engr.

N. Y., Elmira—City Council sewage treatment plant, improving present sewerage system. $1,000,000. Remington, Vosbury & Goff, 509 Cooper St., Camden, N. J., engrs.

N. D., Minot—City, G. A. Reishus, aud., 30 in. vitr. clay or concrete sanitary sewers in east section city. $50,000.

Utah, Bingham—Preliminary plans 1 mi. 36 in. concrete storm sewer. $17,000. Engineer not appointed.

Ont., Barrie—Council, storm sewers in Essa Rd., Grove, Brock, Dunlop, Penetan and Tiffin Sts.; concrete paving Elizabeth, Ower, Clapperton, James and McDonald Sts. $100,000. W. Smith, town clk. Engineer not appointed.

Ont., Peterborough—City, plans 8 or 12 in. vitr. tile or concrete storm sewer, Park St., earth trenching. $32,700. R. H. Parsons, City Offices, engr.

Ont., Toronto—City, plans ¾ mi. concrete, brick, trunk storm sewer, for completion of Rosedale Relief sewer. $140,000. R. C. Harris, City Hall, engr.

Ont., Toronto—East York Twp., plans 3 mi. 8 in. and up, vitr. tile sanitary sewers, house connections, manholes, earth trenching, Regent Park Dist. $65,000. G. R. Jack, 443 Sammon Ave., engr.

Ont., Trenton—Town, plans 2 mi. 12 to 14 in. vitr. tile or concrete pipe storm and sanitary sewers, earth trenching, Bay, Marmora, Spring and West Sts. $25,000. W. G. Perks, Trenton, engr.

Ont., Welland—Council sewer and water-main extensions, concrete paving. $40,000. C. Coulson, city engr.

BIDS ASKED

Calif., Los Angeles—Oct. 21, by Bd. P. Wks., City Hall, Sect. 1, Wilmington Intercepting Sewer, precast rein.-con. or semi-elliptic brick concrete pipe. $110,000.

Ky., Louisville—Oct. 27, by Commissioners of Sewerage, 400 Marion E. Taylor Bldg., Mon-

See proposal advertising on page 66

Constr. News page 141

LEADITE

reduces costs

More than a Quarter Century's use has shown that LEADITE makes a tight joint (*water waste surveys prove that Leadite makes "very tight" joints*),—and that it is economical to use for the following reasons: (1) Saves in cost of material (2) Saves caulking expense item (3) Saves expense of large bell hole digging (4) Reduces trench pumping expense (5) Saves time in preparing because Leadite melts at a low temperature (6) Saves in handling charges on the job because it is light in weight and easy to handle (7) Saves in freight and hauling charges because it is light in weight.

The pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%.

THE LEADITE COMPANY
Land Title Building - - - Philadelphia, Pa.

No Caulking

Sewers (Continued)

tana Avenue Sewer, Sect. B. Contr. 61. W. M. Caye, 400 Marion E. Taylor Bldg., technical engr.

Nev., Las Vegas—Oct. 26, by City Council, sewage disposal plant, sewer mains. $160,000 available. Noted Sept. 3.

N. J., Morris Plains—Dpt. Institutions & Agencies, State House, Trenton, taking bids altering and new sewage disposal plant addition, at New Jersey State Hospital. $25,000. Dpt. Architecture & Constr., State House, Trenton, engrs.

N. Y., Comstock—Oct. 20, at office Dpt. Correction, W. N. Thayer, Jr., comr., State Office Bldg., Albany, sewage disposal system at Great Meadow Prison, Washington Co.; adv. E.N.-R. Oct. 15.

N. Y., New York—Oct. 20, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., installing 2 sewage pumps, motors, control apparatus, piping, valves, appurtenances, altering existing electric light wiring system in main pumping station of sewerage system of Mount Kisco, Westchester Co.

Que., Montreal—Oct. 16, by City, St. Pierre River Sewer, 7,565 ft. rectangular shaped rein.-con. sewer, 46 ft. wide, from St. Mabroise to St. Lawrence River, passing under Lachine Canal and Canadian Natl. R.R. $2,000,000.

CONTRACTS AWARDED

Calif., Glendale—City Council, 6 and 8 in. vitr. sewers in Bohlig St., to R. A. Wattson, 1026 North McCadden Pl., Los Angeles, $19,670.

Calif., Oakland—G. E. Gross, clk., Alameda Co., rein.-con. box storm sewer in Hayward-Mt. Eden Rd., to L. C. Seidel, 680 14th St., $19,640.

Kan., La Crosse—Sewers in Dist. 1, also sewage disposal plant, to C. L. Burt, 1005 North Washington St., Hutchinson, $53,400.

Md., Baltimore—Bd. Awards, sanitary sewers and storm drains in Sanitary Contr., to N. Martell, 4400 Vesta Ave., $28,538. Noted Sept. 17.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., sewerage works in Baker St., West Roxbury, to M. DeSisto, 198 Lagrange St., West Roxbury. Est. $25,000. Noted Sept. 17.

Mass., Boston — City, Savin Hill Bay Sewerage, Sect. 2, Dorchester, to A. Baruffaldi, 52 Powder House Blvd., Somerville, $69,516.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg. to J. Delico, 9839 Old South Rd., Ozone Park., sewers in 51st St. $1,380, 207th St. $753; to E. Meluccio, 1209 61st St., Brooklyn, 58th Rd. $2,347; to Franciose & Giamarco, 88th Dr. $4,260; to C. Soverio, 157th Ashford St., Brooklyn, 237th St. $3,389, 134th St. $4,364, 240th St. $4,349; to J. Lo Schaibo, 2315 Avenue U, Brooklyn, 93rd Dr. $3,604, 161st St. $1,229, Beach 38th St. $4,681; to Belfatto Contg. Co., Foch Blvd., South Ozone Park, 100th Ave. $1,628, 100th Ave. $2,448; Desare Rd. $2,207; to A. Maio, 494 6th Ave., 107th Ave., $1,498. to A. Clemente, 173rd St. $1,961; to P. Ambrosia, 674 Glenmore Ave., Brooklyn, 209th Pl. $2,950. Grand total $43,048. Noted Sept. 10.

O., Akron—E. A. Kemmler, dir. P. Serv., 3,100 ft. 24 and 30 in. vitr. clay trunk sewer outlet for Allenside Allotment, Allenside Dist. Sanitary Trunk Sewer, incl. 5,000 ft. piling, 370 cu.yd. rein.-con., to F. George, 1657 Mahoning Ave., Youngstown, $28,288. Est. $38,500. Noted Sept. 24.

O., Findlay—Intercepting sewerage system to connect with new sewage disposal plant, to Frank George Co., 1657 Mahoning Ave., Youngstown, $109,974 est. $125,000; sewage disposal plant, to A. Beltney & Sons, Toledo. $196,454 est. $200,000. Noted Aug. 27.

Okla., Lawton—State Bd. Affairs, new sewage disposal plant for Cameron School of Agriculture, to Sherman Iron Wks., 18 East Main St., Oklahoma City. $27,100. Est. $30,000. Noted May 21.

Okla., Oklahoma City—City Council, 9,877 lin.ft. 42 and 39 in. sewer pipe, to Lock Joint Pipe Co., Ampere, N. J., $26,377. Est. $31,000.

Okla., Tulsa—City Comrs. E. Logan, aud., Sewer Project 3-A-30, South Section Hartford Ave. to C. M. Brown, 1315 South Trenton St., $31,328. Est. $56,515. Noted Sept. 24.

Okla., Tulsa—City Comn., E. Logan, aud., 17,730 ft. clay liner plates, 137,570 lb. reinforcing bars, 1,472 cu.yd. earth, 490 cu.yd. loose rock, 9,228 cu.yd. solid rock excav., reinforcing bars, concrete materials, manholes, North Section Hartford Ave., Project 3-B-30, to Roach & Wood, 1112 South Evanston St., $28,239. Est. $55,470. Noted Sept. 22.

Pa., Wilmerding—Boro Council, 4 x 6 in. brick, concrete storm water sewer in Patton St. from Shaw St. to Turtle Creek, to P. Ceresa, 244 Card Ave., $11,500.

BRIDGES

PROPOSED WORK

Kan., Wichita—City, c/o C. C. Ellis, clk., 7 span 258 x 40 ft. bridge on concrete piers, abutments, concrete decks, two 8 ft. sidewalks, rein.-con. handrails 8 street lights, 800 ft. curbing and guttering, 1,200 sq.yd. brick paving, 7,610 ft. piling, 204,693 lb. reinforcing, 1,116 lb. structural and 15,150 lb. cast steel over Little Arkansas River, at 13th St., to O. C. Tyler, Blackwell City, Okla., $43,576. Noted Sept. 24.

Minn. St. Paul—Ramsey Co. selling $1,000,000 bonds this month, bridges, improving streets and roads. P. N. Coates, Guardian Life Bldg., c/o by. engr.

N. J., Paterson—Bd. Freeholders, Passaic Co., Court House, preliminary plans beam bridge at rear Wanaque Station, over brook, at Wanaque. $25,000. G. Ferguson, co. engr.

N. J., Scotch Plains—Bd. Freeholders Union Co., Court House, Elizabeth, preliminary plans 2 bridges, culverts, $25,000. R. C. Collins, 80 Broad St., Elizabeth, co. engr.

Okla., Antlers—State Hy. Dpt., Oklahoma City, preliminary plans 7 span 136 ft. rein.-con. bridge, Pushmataha Co. $35,000. C. L. Wilson, Oklahoma City, hy. engr.

Texas—Missouri, Kansas & Texas Ry. Co., F. Ringer, ch. engr., St. Louis, Mo., Bexar Co., H. Goodman, co. engr., Court House, San Antonio, and State, 210 ft. rein.-con. underpass, 24 ft. wide, on San Antonio-Austin Hy., near Fratt. $60,000.

Utah, Salt Lake City—City and Denver & Rio Grande R.R., Western R.R. Co., A. O. Ridgway, ch. engr., Equitable Bldg., Denver, Colo., steel, concrete viaduct over railroad tracks at 13th St. East and 21st Soth Sts. $25,000. H. Jessen, city engr.

Ont., Toronto—City Council plans two 150 ft. to 200 ft. long 66 ft. wide, structural steel truss or plate girder and concrete bridges over railway tracks Dundas St., for College St. extension, west of Lansdowne Ave. $275,000. R. C. Harris, City Hall, engr.

Ont., Toronto—Replacing existing bridge over Don River, Eastern Ave., with 140 ft. steel plate girder or truss span bridge, 60 ft. wide, concrete founds., flooring, abutments, railing, etc. $150,000. R. C. Harris, City Hall, engr.

BIDS ASKED

Calif., Los Angeles—Oct. 26, by Bd. Supervs, Los Angeles Co., three 21 ft. span, redwood or Douglas fir bridge, concrete deck, 20 ft. roadway, over Rubio Wash at Romona Blvd.

Louisiana—Oct. 20, by State Hy. Comm., Baton Rouge, Bayou Bienvenue Bridge on Versailles-Chef Menteur Hy., Orleans and St. Bernard Parishes, incl. 160 ft. swing span on concrete capped creosoted timber piles, fourteen 20 ft. combination I-beam spans on creosoted timber piling, 20 ft. roadway. H. B. Henderlite, hy. engr.

Michigan—Oct. 21, by A. L. Burridge, div. engr. Cadillac, MB 1 of 40-5-3, Contrs. 2 and 3, Kalkaska Co.—Federal Aid Grade Separation 1 of 35-1-7, Contrs. 1 and 2—Federal Aid Grade Separation 2 of 35-1-7, Contrs. 1 and 2, both Iosco Co.

Michigan—Oct. 22, by H. G. Oakes, div. engr., Plymouth, at office Ingham Co. Road Commissioner, Mason, State Reward Bridge 1 of 33-16-21, Contrs. 2 and 3, Ingham Co., for State Hy. Dpt., Lansing.

Michigan—Oct. 23, by H. G. Oakes, div. engr., Plymouth, FB1 of 23-5-4, Contrs. 1 and 2, and Federal Aid Bridge 2 of 23-5-4, Contrs. 1 and 2, Eaton Co., for State Hy. Dpt., Lansing.

Minnesota—Oct. 20, by State Hy. Dpt., St. Paul, Bridge 5122, 100 x 40 ft., concrete at Grand Rapids, State Project 35-22; Bridge 5180, 140 ft. long, at Richmond, State Project 23-28-2 Stearns Co. Engineering Dpt. of owners, engrs.

Minn., Hopkins—Oct. 20, by State Hy. Dpt., St. Paul, Bridge 5113, 3 span, 35 ft., concrete, State Project 12-28, west of here, Hennepin Co.

New York—Oct. 27, by F. S. Greene, supt. Dpt. P. Wks., State Office Bldg., Albany, substructure Troy-Menands Bridge, Contr. 2, Albany and Rensselaer Counties, $607,081; adv. E.N.-R., Oct. 15.

New York—Nov. 10, by F. S. Greene, comr. Dpt. P. Wks., State Office Bldg., Albany, constructing Albany-Rensselaer Bridge and grade crossing elimination, Albany and Rensselaer Counties, $3,578,881; adv. E.N.-R. Oct. 15.

N. Y., Buffalo—Nov. 5, at office Dpt. P. Wks., W. A. Rathman, comr., bridge over Buffalo River, South Milwaukee Ave. Noted Oct. 8.

Pennsylvania—See "Streets and Roads."

Wash., Seattle—T. D. Hunt, engr., Kings Co., bids about Nov. 5, 2 untreated timber trestles at Factoria and Juanita on east shore of Lake Washington. $45,000.

Ont., Toronto—Oct. 23, by W. J. Stewart, mayor, City Hall, 150 ft. plate girder span bridge, steel floor beams, concrete flooring, and handrailing, over Don River at Keating St. $100,000. R. C. Harris, City Hall, engr. Noted July 9.

CONTRACTS AWARDED

Calif., Red Bluff—Bd. Supervs. Tehama Co., Bend Bridge, steel, wooden trestle approach over Sacramento River, 6 mi. north of here, to R. B. McKenzie, Red Bluff, $40,550. Noted Sept. 3.

Illinois — State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, to S. J. Groves & Sons Co., 306 Globe Bldg., Minneapolis, Minn., bridges on Route 22, Sect. 23-RB Cook Co. $7,588; Route 20, Sect. G-RB Lake Co. $8,168—to Decker & McDowell, Chicago, Route 4, Sect. 430-VB Cook Co. $38,753—to Zimmerly Bridge Co., Paris, Route 101, Sect. 120-XB Schuyler Co., $7,668—to J. C. Paskins Co., 208 South LaSalle St., Chicago, Route 55, Sect. 552-B DuPage Co. $27,701—to S. J. Groves & Sons, Libertyville, Route 53, Sect. 533H, DuPage Co. $70,588—to Acme Eng. & Constr. Co., 20 North Wacker Dr., Chicago, Route 53, Sect. 534-H DuPage Co. $133,962—to Duffin Iron Co., 37 West Van Buren St., Chicago, Route 46, Sect. 462-VC Cook Co., $342,351—to Clinton Bridge Wks., Clinton, Ia., Route 97, Sect. 142-C Fulton Co. $17,028; Route 48, Sect. 136B Christian Co. $11,177—to E. J. Albrecht Co., 2632 West 26th St., Chicago, Route 46, Sect. 462-VB Cook Co. $110,584—to F. Hillquist, Geneva, Route 97, Sect. 142-B Fulton Co. $38,679—to D. W. Chapman, Vienna, Route 146, Sect. 111V-B Johnson Co. $2,034—to Des Moines Asphalt Paving Co., 2nd and New York Sts., Des Moines, Ia., Route 89-C, Sect. 105-B Marshall and Putnam Counties $47,103—to F. D. Hayes, Janesville, Wis., Route 71, Sect. 115-B Lee Co. $7,984—to Madison Constr. Co., Edwardsville, Route 100, Sect. 124-B Calhoun Co. $28,590—to Clinton Eng. Co., Clinton Ia., Route 9 Sect. 48-B Peoria Co. $68,585; Route 124, Sect. 102-B Sangamon Co. $116,951; Route 124, Sect. 101-B Sangamon Co. $9,178—to G. W. Condon Co., Grain Exch. Bldg., Omaha, Neb., Route 4, Sect. 65-B $7,040; Route 4, Sect. 66-B $6,248; Route 11, Sect. 47-B $7,672, all Madison Co.—to Midwest Imprvt. Co., 3525 South Leavitt St., Chicago, Route 5, Sect. 7YV Cook Co. $14,624—to H. C. Holmes, Macomb, Route 95, Sect. 122-VB McDonough Co. $9,959—to S. J. Cohen Co., Blythesville, Ark., Route 150, Sect. 136-B-1 Alexander Co. $41,841—to A. P. Munsen, Marion, Ia., Route 78, Sect. 109-VB Carrol Co., $3,596. Grand total $1,185,652. Noted Apr. 30, May 7, Aug. 20 and Sept. 3.

N. Y., Buffalo—G. C. Minnis, ch. engr. Grade Crossing Comn., 1036 Ellicott Sq., approach work in connection with Amherst-Austin-Tonawanda Streets grade crossing elimination, Austin St., to M. A. Rupp, 46 Haven St., Buffalo, $55,700. Noted Sept. 10.

N. Y., Hudson Falls—R. D. Hayes, comr. Canals & Waterways, Albany, bridge, approaches over Glens Falls Feeder, Main St., Contr. M-74, to Scott Bros. Constr. Co., Inc., 235 Dominick St., Rome, $29,196, est. $39,500; fabricating, furnishing, delivering structural steel, counterweights, machinery, Contr. M-75 to Hardie-Tynes Mfg. Co., 800 North 28th St., Birmingham Ala., $8,068 est. $11,068. Noted Sept. 17.

Okla., Araphoe—Custer Co., bridge over Washita River, Project 1-C, bridges over West and East Barnitz Creeks to Ledford & Way, Walters, $26,578—Projects 1-F and 1-G, to Nims & Frost, Hydro, $11,105 and $11,131 respectively—bridge over Beaver Creek, Project 1-L, to J. Biggs, Clinton, $9,527—bridge over South Canadian River, to Green Constr. Co., 5194 West Main St., Oklahoma City, $215,962—bridge over Washita River, Project 2-B, to Boardman Co., Maple and Hawk Sts., Oklahoma City, $9,711. Grand total $284,014. Noted Aug. 20.

Pennsylvania — State Hy. Dpt., Harrisburg, two 40 ft. span rein.-con. beam bridge, 20 ft. roadway, incl. 47,508 lb. steel bars, 2,755 lb. fabricated steel, Route 732, Tyrone Twp., Blair Co., to E. R. Vipond, Hollidaysburg, $11,089; two 36 ft. span rein.-con. beam bridge with 23 ft. roadway, incl. 31,040 lb. steel bars, 2,401 lb. fabricated steel, Route 322, Scott Twp., Lackawanna Co., to Connell & Laub, Berlin, $12,715. Noted Sept. 17 under "Streets and Roads."

Pa., Latrobe—Bd. Supervs, Westmoreland Co., Brewery Bridge, lengthening and encasing present stone and abutments with concrete, 2 new concrete piers, 180 ft. steel and concrete superstructure, 30 ft. roadway, two 6 ft. sidewalks, paving approaches, to Ligonier Constr. Co., Ligonier, $39,740.

Tex., Houston—Rein.-con. bridge over Brays Bayou, 75th St., to J. E. Johnson Constr. Co., 523 Colquitt St., $49,700.

STREETS AND ROADS

BIDS ASKED

California—Oct. 21, by State Hy. Comm., Sacramento, grading, concrete paving 0.5 mi. at Bradley, Monterey Co. C. H. Purcell, hy. engr.

Minnesota—Oct. 20, by State Hy. Dpt., St. Paul, grading, portable and monolithic culverts 20 mi. State Project 1-45, Sect. 2, incl. 565,000 cu.yd. excav. — 4.1 mi. State Project 3-53, Sect. 3, 112,318 cu.yd. excav.—7.5 mi. State Project 4-50, 128,411 cu.yd. excav.—10.3 mi. State Project 9-22-A, 203,306 cu.yd. excav.—13 mi. State Project 21-26, Sect. 1 and State Project 21-24, Sect. 4, 395,000 cu.yd. excav.—9.1 mi. State Project 23-28, Sect. 2, 328,500 cu.yd. excav.—gravel surfacing 25.2 mi. State Project 61-23 20,160 cu.yd. gravel. Engineering Department of owners, engrs.

N. Y., Long Island City—Oct. 19, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., grading, curbing, sidewalks, stone block guttering 52nd Dr.—grading, sheet asphalt on concrete paving Myrtle Ave.—grading, curbing, sidewalks on Onderdonk and Borden Ave., 112th and 65th Sts.

N. Y., St. George—Oct. 21, by J. Lynch, pres. Richmond Boro, Boro Hall, bituminous macadam paving Midland Ave.; concrete curbing, brick guttering. Barnard Ave.

O., Cleveland—Oct. 16, by Cuyahoga Co., paving Noble Rd. 3, $26,800. F. Williams, Court House, engr.

Pennsylvania—Oct. 23, by State Hy. Dpt., Harrisburg, grading drainage structures, one course rein.-con. paving 4,782 sq.yd. full width, 1,550 sq.yd. half width Route 622, Perry Twp., Jefferson Co.—grading, drainage structures, one course rein.-con. paving 5,592 sq.yd. road, and 854 sq.yd trolley section, bituminous surface treated macadam paving 1,102 sq.yd. Route 442, Manheim Twp., Lancaster Co.—621 ft. viaduct, incl. one 87 ft. 10 in., and one 70 ft. 10 in. deck plate girder spans, six 55 ft. 9 in. and two 60 ft. 6 in. rein.-con. girder spans, part curve and part tangent, on timber and concrete piles over Erie R.R. and Lackawanna River at Station 547 plus 06.25, Route 296, Clifford Twp., Susquehanna Co. S. S. Lewis, hy. engr.; adv. E.N.-R. Oct. 15.

Tenn., Memphis—City Council rejected bids concrete paving 8,500 sq.yd. North 3rd St. from Bickford to Cedar Sts. $30,201. W. B. Fowler, City Hall, engr. Noted Sept. 10.

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Streets and Roads (Continued)

Tex., El Paso—City, c/o City Secretary, taking bids permanent paving Olive, Henderson, San Jose, Alabama and Kentucky Sts. $125,000. Address City Engineer.

Wash., Ephrata—Oct. 20, by Comrs. Grant Co., grading, surfacing 6.56 mi. Lateral Hy. 7 and 8.92 mi. Lateral Hy. 6, A. B. Humason, Ephrata, co. engr.

Wash., Seattle—King Co. bids about Nov. 1, grading, bridging 1.5 mi. Enumclaw-Black Diamond Cutoff. $120,000. T. D. Hunt, Seattle, co. engr.

Wash., Walla Walla—Comrs. Walla Walla Co., Court House, bids about Oct. 30, 6 mi. Smith Springs-Columbia Co. Hy. $50,000. E. R. Smith, Walla Walla, co. engr.

CONTRACTS AWARDED

Arizona—State Hy. Comn., Phoenix, grading, improving Globe Safford Rd. F.A.P., 87-E, to Dudley Stone Products Co., Box 108, El Paso, $15,158; 1.1 mi. Prescott-Phoenix Rd., F.A.P. 72-A, to Packard & Tanner, 905 West Latham St., Phoenix, $27,772.

Calif., Fairfax—L. A. Grosbauer, city clk., grading, emulsified asphaltic paving San Rafael-Olema Rd., et al., to P. S. Harless, San Rafael, $22,816. Noted Sept. 17.

Calif., Gilroy—E. F. Rogers, city clk., grading, asphaltic concrete paving Martin Lane, Monterey St., et al., to Union Paving Co., Call Bldg., San Francisco, $27,806. Noted Sept. 10.

Calif., Los Angeles—Los Angeles Co., grading, asphaltic concrete paving Foothill Blvd., Cash Contr. 426, to Hall-Johnson Co., Box 387, Alhambra, $35,750, grading, drainage structures, 9-7-7-9 in. concrete paving 600,000 sq.yd. Foothill Blvd., Co. Impvt. 936, to G. H. Oswald, 366 East 58th St., $197,251.

Calif., Menlo Park—F. L. Kurtz, city clk., grading, asphaltic concrete paving Live Oak Ave., et al., to Valley Paving & Constr. Co., Bank of America Bldg., Fresno, $22,215.

Calif., Oakdale—City Council, grading, curbing, sidewalks, concrete paving 122,500 sq.ft. F St., to Valley Paving & Constr. Co., Bank of America Bldg., Fresno, $29,876. Noted Sept. 10.

Calif., San Bernardino—San Bernardino Co., grading, drainage structures 1.156 mi. Mill Creek National Forest Hy., Sect. B, Route 68, to G. Herz & Co., Ltd., 310 Platte Bldg., $36,572.

Calif., San Jose—Bd. Supervs. Santa Clara asphaltic concrete surfacing Alameda Rd., and asphaltic concrete resurfacing Homestead Rd., to Union Paving Co., Call Bldg., San Francisco, $23,725 and $7,110, respectively.

Idaho—A. Harbour, constr. P. Wks., grading, surfacing 7.049 mi. Buhl-Clover Hy. between Buhl and Clover, Twin Falls Co., to Lloyd Goodrich, Jerome, $27,046. Noted Sept. 17.

Illinois — State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, to L. D. Lain Co., Park Ridge, paving Route 19, Sect. 86-Y, $39,584; Route 584-Y, $112,156; Route 60, Sect. 120-Y, $106,416, all Cook Co.—to Arcole Constr. Co., Niles Center, Route 46, Sect. 464-MY Cook Co. $37,925; Route 54, Sect. 542 DuPage Co. $108,000; Route 71, Sect. 115 Lee and DeKalb Counties $160,954 — to George Welch, Beloit, Wis., Route 63, Sect. 631-X-1 Cook Co. $12,868 —to Gund-Graham Co., Freeport, Route 85, Sect. 102 Mercer Co. $128,500; Route 47, Sect. 106 Kane Co. $108,764—to E. D. Otto, Downers Grove, Route 59, Sect. 113-W Will Co., $5,377 —to Pronger Constr. Co., Blue Island, Route 40, Sect. 146-X Cook Co. $24,303—to McMahan Constr. Co., Rochester, Inc., Route 47 Sect. 125-X Livingston Co. $6,282—to McCarthy Impvt. Co., Kahl Bldg., Davenport, Ia., Routes 103 and 104, Mercer Co. $91,200; Route 146, Sect. 106 Union Co. $162,633; Route 146, Sect. 107 Johnson Co. $128,210; Route 77, Sect. 105W-1, Ogle Co. $2,428; Route 77, Sect. 105W-1, Ogle Co. $6,843; grading Route 97, Sect. 142-A Knox and Fulton Counties $59,989—to Hartman-Clark Bros. Co., 920 Peoria Life Insurance Bldg., Peoria, paving Route 156, Sect. 124-X McLean Co. $2,738; Route 9, Sect. 46-X $10,646; Route 9, Sect. 46X-1 $14,584; Route 9, Sect. 48 $19,614; Route 9, Sect. 48-X $5,014; Route 88, Sect. 126 $13,523, all Peoria Co.; Route 120, Sect. 115 Piatt Co., $88,238; Route 48, Sect. 137 Christian and Montgomery Counties $107,438—to J. R. Feigel Co., 605 Adams Ave., Evansville, Ind., Route 146, Sect. 107--S Johnson Co. $6,951—to Nelson Constr. Co., Jerseyville, Route 127, Sect. 103 Montgomery Co. $47,645—to Cameron-Joyce & Co., Keokuk, Ia., Route 99, Sect. 105 McDonough Co. $81,949—to J. Kesl & Sons, Edwardsville, Route 150, Sects. 134 and 135 Alexander Co. $99,932—to J. C. O'Connor & Sons, 2104 Miner Ave., Ft. Wayne, Ind., Route 104, Sect. 143-X Christian Co. $31,204—to E. A. Meyer Constr. Co., Highland Park, Route 19, Sect. 88-I Cook Co. $73,845—to P. F. McFarland Co., Joliet, Route 53, Sect. 538-W Will Co. $11,259—to Stanley Jaicks, Oak Park, Route 53, Sect. 534-X DuPage Co. $132,168—to H. H. Gunther Constr. Co., Galesburg, Route 28, Sect. 1-W Knox Co. $3,819—to Chicago Heights Coal Co., Chicago Heights, Route 53, Sect. 539-X ook Co. $81,065; Route 52, Sect. 524 Cook Co. $257,776—to Bishop Constr. Co., Danville, Route 130-A, Sect. 101 Jasper Co. $76,495—to S. J. Groves & Sons Co., Libertyville, grading Route 100, Sect. 124-A Calhoun Co. $88,748—to M. Wunderlich, St. Paul, Minn., Route 124, Sect. 101-A Sangamon Co. $24,721; Route 147, Sect. 116-A Johnson and Pulaski Counties $59,612—to Jansen & Schaefer, Pekin, Route 89-C, Sect. 105-A Put-

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nam Co. $56,881—to T. McQueen, Forest Park, gravel surfacing Route 18, Sect. 8-VA Cook Co. $14,896. Grand total $2,713,193. Noted Apr. 30, May 7, Aug. 20 and Sept. 3.

Ill., Salem—Bd. Comrs. Marion Co., traffic bound surfacing 1.6634 mi. State Aid Route 14A, Sect. 5-M.F.T., 18 ft., to J. R. Vursell, Salem, $9,226; gravel surfacing 2.0363 mi. State Aid Route 12, Sect. 3-M.F.T., 18 ft., with 6 ft. earth shoulders, to T. J. Crowley & Sons, Centralia, $12,893.

Ia., Cedar Rapids—G. A. Senninger, aud. Linn Co., surfacing trunk roads, incl. 14,800 cu.yd. crushed stone, 89,005 yd. ¾ mi. additional haul, local roads, incl. 2,050 cu.yd. crushed stone, 200 cu.yd. rubble, to M. O. Weaver, Iowa Falls, $19,705.

Ia., Le Mars—Plymouth Co., gravel surfacing secondary roa dsystem, to Ferguson Diehl Constr. Co., Dana, $14,790.

Ia., Marion—Linn Co., grading roads, to Clear Lake Constr. Co., Clear Lake, $8,247; crushed stone surfacing, to M. O. Weaver, Iowa Falls, $18,827.

Ia., Sigourney—Bd. Comrs. Keokuk Co., grading local roads in Jackson Twp. and Trunk Road N, to G. H. Lowe, 1612 Greene Ave., Cedar Rapids, $9,574 and $2,543 respectively. Noted Sept. 3.

Ia., Wapello—Louisa Co., graveling roads, to P. P. Hinote, Oakville, $21,697, to L. Plumb, Wapello, $6,314, and to R. Patterson, Wapello, $1,333. Grand total $29,344.

Kan., Kansas City—City Council, 3 in. brick paving 18th Street Traffic Way from Kansas Ave. to south end 18th Street Viaduct, to E. J. Wetterstrom, 1615 Main St., $11,758—concrete sidewalks on 36th St., to Drexel Constr. Co., Kansas City, $49—7th Ave. and 10th Street Traffic Way, to E. F. Haim, Kansas City, $2,640. Grand total $14,407. Rejected bids grading 60 ft. wide, paving 45 ft. wide State Street Traffic Way from 25th St. to city limits, $84,000. C. E. Peterson, City Hall, engr.

Kan., Stockton — Curbing, guttering, brick paving, to Cook & Ransom, Ottawa, $40,270.

Kentucky—State Hy. Dpt., Frankfort, gravel surfacing 9.909 mi. Calhoun-Beech Grove Rd., State Aid Project 2¼ D.S., McLean Co., to Corum Bros., Madisonville, $20,030. Noted Aug. 6.

Kentucky—State Hy. Dpt., Frankfort, grading, drainage structures, using first class rein.-con. pipe 6.864 mi. Bardwell-Columbus Rd., State Aid Project 7-AG, Carlisle Co., to McDade & McDade, Fulton, $35,821. Noted Sept. 3.

Maryland—State Roads Comn., G. C. Uhl, chn., Baltimore, concrete paving 1 mi. Contr. Wo-104-12, Worcester Co., to Phillipps Bros., Salisbury, $23,961. Noted Sept. 24.

Maryland—State Roads Comn., G. C. Uhl, chn., Baltimore, macadam paving 2.01 mi. Contr. M-177-24, Montgomery Co., to Thomas, Bennett & Hunter, Westminster, $46,924; 1 mi. Contr. W-96-62, Washington Co., to Bester, Long Co., Hagerstown, $26,900. Noted Sept. 17.

Massachusetts—Dpt. P. Wks., A. W. Dean, engr., Boston, gravel and bituminous macadam surfacing 3 sections 1,290 ft. 3 sections hy., incl. rein.-con. and steel stringer bridges, Chesterfield and Williamsburg, to Warner Bros. & Goodwin, Sunderland, $30,680—350 ft. hy., incl. concrete bridge extension, Townsend, to P. J. Keating, 107 Kimball St., Fitchburg, $4,485—515 ft. hy., incl. steel stringer bridge, Bourne, to Atwood-Thomas Constr. Co., 17 Prospect St., Middleboro, $28,262—bituminous macadam surfacing 17,531 ft. 2 sections hy., Chicopee, to Daniel O'Connell Sons, Inc., 480 Hampden St., Holyoke, $90,047. Grand total $143,474. Noted Sept. 24.

Mass., Boston—Dpt. P. Wks., bitulithic paving Seaver and Winter Sts., Ward 14, Dorchester, to John Kelly Co., Inc., 31 Round Hill St., West Roxbury, $19,488. Est. $25,000.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt paving Barker St., et al, to Boston Granolithic Works, 32 Hull St. Est. $25,000. Noted Oct. 1.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., edgestone, sidewalks, sheet asphalt paving Sydney St., Ward 13, to J. J. McCarthy, 121 Boylston St., Dorchester, $18,520. Est. $25,000. Noted Sept. 17.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt paving St. Alphonsus St. to Baker, Matz & Co., 1570 Tremont St., Roxbury, $24,860. Est. $25,000 or more.

Mich., Munising—Concrete curbing, guttering, one course concrete paving, 17,005 sq.yd. to L. W. Brumm, Marquette, $27,091.

Minn., St. Paul—C. A. Carlson, city purch. agt., paving Snelling Ave., between Shields and Van Buren Sts., to Fielding & Shepley, 240 University Ave., St. Paul, $36,989; Burns Ave. between Point Douglas Rd. and Johnson St., to Feyen Constr. Co., 277 Burgess St., St. Paul, $21,600.

Nebraska—State Hy. Comn., Lincoln, grading, concrete surfacing 295,680 sq.yd. Calhoun-Blair Rd., to Western Asphalt & Paving Corp., Sioux City, Ia., $60,000.

Neb., Lincoln—State, c/o State Capitol Comn., grading, at State Capitol to Abel Constr. Co., Terminal Bldg., $19,750; concrete drives, walks, to Metz Constr. Co., Springfield, $29,500.

Neb., Lincoln—Bd. Regents University of Nebraska, paving central mall east side 16th St. between S and U Sts., to Roberts Constr. Co., Terminal Bldg., $23,349.

N. J., Elizabeth—Union Co., Court Hou paving 1.111 mi. Glenside Ave., Summit Petrozzello Bros. 362 Lackawanna Rd., Sou Orange, $41,889 North Broad St., Hillside, Union Paving Co., Newark, $24,407.

N. Y., Brooklyn—H. Hesterberg, pres. Broo lyn Boro, Boro Hall, grading, asphalt pavi East 17th St. and bituminous concrete pavi East 18th Sts., to B. Turicamo, New Crop Lane $26,855 and $16,332 respectively—gra ing, asphalt paving East 37th St and aspha paving Avenue K. to Brooklyn Alcatraz A phalt Co., 407 Hamilton Ave., $4,936 and $2 961 respectively—Elton St., to Pomonak A phalt Co., 1246 Grand St. $5,282—West 4th S to D. J. McCoy Asphalt Co. Avenue U and Ea 57th St., $3,695 — grading Stanley Ave., Heapy Constr. Co., 115 78th St., $1,035. Gra total $85,196. Noted Sept. 10.

N. Y., Long Island City—G. U. Harvey, pre Queens Boro, Queens Subway Bldg., asphal paving Roosevelt Ave., to Borough Asphalt Co 407 Hamilton Ave., $20,467—107th Ave. an Justice St., to Meehan Paving Co., Laurel Hi Blvd., $9,558 and $18,043 respectively—New ton Rd., to Pomonak Asphalt Paving & Mat rial Co., 1246 Grand St., Brooklyn, $10,441— 75th St., to Highway Impvt. & Repair Co Furmans Island, Brooklyn, $6,036—gradin 162nd St. to M. Cafazzo, 1043 36th St., Brook lyn, $1,233—108th St., to Tully & DeNapoli 30-11 Sherman St., Astoria, $1,303—Utopi Parkway, to Ackerman & Schimberg, $9,86 Grand total $76,944. Noted Sept. 24.

N. Y., New York—S. Levy, pres. Manhatta Boro, Municipal Bldg., to Meehan Paving Co 90 West St., granite block paving 60th St $25,242; Park Pl. $15,996; asphalt paving Liberty St. $4,309; Centre St. $11,726; to E. T Barry, 126-06 139th Ave., Laurelton, Exchange Pl. $2,310; to St. George Paving Co., 415 Lexington Ave., 23rd St. $28,777; Hudson St $11,464. Grand total $99,824. Noted Sept. 17.

O., Cleveland—Cuyahoga Co., paving Harvard Rd. 5 from Harvard Denison Bridge to East 55th St., to Enterprise Paving & Constr. Co., 8444 Bway., $72,500. Est. $91,000.

Pennsylvania — State Hy. Dpt., Harrisburg, grading, concrete surfacing 9,800 sq.yd. Erie Co., to McDermott Constr. Co., Niles, O., $29,543—concrete surfacing 1,564 sq.yd. Northampton Co., to R. E. Neumeyer, Bethlehem, $5,274—6 in. slab or stone surfacing 14,256 ft. Allegheny Co., to D. W. Challis & Son, Sewickley, $15,782—native stone macadam surfacing 23,562 ft., Clearfield Co., to J. M. Hutchison, Altoona, $19,472—bank gravel surfacing 54,739 ft. Crawford Co., to Davis & Patterson, Linesville, $22,919. Grand total $92,990. Noted Sept. 17.

Pa., Greensburg—G. A. McDowell, controller Bd. Comrs. Westmoreland Co., rein.-con. surfacing 3,925 ft. Unity Twp. Rd., and approach to Route 119, 16 ft., to A. Eidenmiller, New Alexandria, $19,000. Est. $25,000.

Pa., Phila.—Bureau Hys., Dpt. P. Wks., City Hall Annex, A. Murdock, dir., to Marino Masse, 3936 North Reese St. grading Anderson St. from Southampton to Gravers Sts. $448—to Union Paving Co., Broad and Stiles Sts., asphalt paving (assessment work) Devereaux St. from Torresdale to Hegerman Sts., $3,768; Foulkrod St. from Tackawanna to Jackson Sts. $1,644; Gray St. from 49th to 52nd Sts. $20,048; James St. from Friendship to Princeton Sts. $2,105, Melvale St. from Ontario to Tioga Sts. $4,250; Valley St. from Harrison to Jackson Sts. $4,895; Windrim St. from Wayne to Germantown Sts. $5,204, 56th St. from Lindbergh St. to Schuylkill River $12,366, county road improving Millett St. from Torresdale to Jackson Sts. $3,802—to Eastern Asphalt Co., Pennsylvania Bldg., asphalt paving (assessment work) Levrick St. from Frankford to Battersby Sts. $11,773; to F. Feraco, 2632 North Lawrence St., hire of motor trucks for hauling road materials, $5,980; to McHugh-Lucus Co., 20 South 15th St., furnishing, erecting fabricated steel smoke plates for Belmont Avenue Bridge $8,744; removing, constructing truck platform scales $594; to Pennsylvania-Jersey Welding Co., 5550 Ridge St., reinforcing existing columns on Spring Garden Bridge over Schuylkill River, $2,455; to T. J. Reilly, 314 South Canal St., gunite repairs to Pine Road Bridge over Pennypack Creek $1,570. Grand total $89,646. Noted Sept. 24.

Pa., Pittsburgh—R. G. Woodside, controller Allegheny Co., grading concrete paving 802 ft. Babcock Blvd. extension, 36 ft., Milvale, and brick on concrete paving 2,626 ft. Cedar Blvd., 27 ft., Mt. Lebanon Twp., to F. D. Sanctis, 410 Marlowe St., $21,709 and $46,848, respectively—grading, rein.-con. paving 4,740 ft. Middletown and Coraopolis Rds., Kennedy Twp., near Corapolis, 20 ft., to M. Manella, Oliver Bldg., $46,947—grading, drainage structures, barriers, limestone and rock asphalt paving 2,902 ft. 1st Ave. 135 ft. west of Cherry St. to Mile Lock Lane, Brackenbridge, to F. S. Tillman, Peoples Bank Bldg., Tarentum, $49,434—440 ft. concrete parapet retaining wall, reconstructing 544 ft. brick on concrete pavemnt, 2,700 sq.ft. concrete sidewalks intersections Carothers Ave. and Caro St. near Finley Ave. to Locust St., Scott Twp., to F. Kaukurin, Wilmerding, $23,399. Grand total $178,973. Noted Sept. 3.

Pa., Pittsburgh—R. G. Woodside, controller Allegheny Co., grading, draining, paving, barriers 17,270 ft. Clever Rd., Kennedy and Robinson Twps., 20 ft., near here, to R. H. Cunningham & Sons, 125 Grant St., Turtle Creek, $208,514.

Pa., Washington — Bd. Comrs. Washington Co., 2 in. bituminous cold mix surfacing Roscoe-Stockdale Rd., to Donora Constr. Co., 1st and

Streets and Roads (Continued)

2nd Sts., Donora, $2,309; 2 in. asphaltic concrete surfacing Pike Run Rd., to W. K. Reed, 1st Natl. Bank Bldg., Waynesburg, $38,594.

Pa., West Leechburg (Leechburg P.O.)—City, waterbound macadam paving 4,182 ft. Main St., 16 ft., to Renaldi & Bartina, Vandergrift, $19,539. Est. $25,000.

Tennessee—State Dpt. Hys. & P. Wks., Nashville, surfacing 3.949 mi. road in Davidson Co., to Foster & Creighton, Amer. Natl. Bank Bldg., Nashville, $71,027—4.918 mi. Hamilton Co., to A. M. Allen, Chattanooga, $69,148—1.55 mi. Monroe Co., to Murray Constr. Co., 508 Union Ave., Knoxville, $25,820—3.706 mi. Carter and Washington Counties, to Pittman Constr. Co., Rhodes Bldg., Atlanta, Ga., $58,612. Grand total $224,607. Noted Oct. 1.

Tex., Corsicana—Concrete paving 6,832 yd. to F. P. McElwrath, Corsicana, $28,530.

Tex., Sinton—San Patricio Co., grading, bridging, caliche surfacing 1.4 mi. Sinton-Sodville Rd. and Sodville-Odem Rd., to Cage Bros., Bishop, $58,950.

Utah—State Hy. Comn., Salt Lake City, grading, surfacing 6.5 mi. Ogden-Evanston Hy., Summit Co., to Utah Constr. Co., Ogden, $47,613. Est. $58,854. Noted Sept. 25 Daily.

Utah—State Road Comn., Salt Lake City, grading, surfacing 4.6 mi. Midland Trail between Green River and Thompson, Grand Co., to Clyde & Whiting, Springville, $21,162, est. $32,058;—bridges on Lincoln Hy., Summit Co., to Knowlton & Rupert, Farmington, $44,536, est. $56,500.

Utah, Springville — Curbing, guttering, widening 3,960 ft. Main St., to Gibbons & Reed, Parleys Canyon, Salt Lake City, $37,683. Est. $43,000. Noted Sept. 17.

Washington—S. J. Humes, engr., State Hy. Dpt., Olympia, grading, graveling 6.5 mi. Ingalls Hill-Packard Creek Rd. King Co., to Morrison & Knudsen Co., Old Natl. Bank Bldg., Spokane, $171,916. Noted Sept. 17.

Wash., Seattle—Bd. P. Wks.—Paving 6th Ave., S. et al., to J. Paduano & Co., 7301 Dibble Ave. N.W., $24,013. Est. $26,000.

Wash., Seattle—Bd. P. Wks., City Hall, paving Lynn and Whiteman Pls., to Queens City Constr. Co., 608 18th Ave., $99,494 and $48,197 respectively.

Wisconsin—State Hy. Comn. and Pierce and Dunn Counties, Eau Claire, grading, crushed stone paving 3.026 cu.yd. Prescott-Ellsworth Rd., to C. F. Sculley Equipment Co., 210 Dakota Bldg., St. Paul, Minn., $17,412. Noted Sept. 18.

Ont., Orillia—Concrete paving Couchiching Beach Rd., to McNamara Constr. Co., 53 Yonge St., Toronto, $30,000.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Calif., Linden—Linden Irrigation District defeated $93,000, irrigation work, incl. pumping plant, pipe lines. F. H. Tibbetts, Alaska Commission Bldg., San Francisco, engr. Noted Sept. 24.

Ind., Michigan City—Bd. P. Wks., City Hall, harbor improvements, water trade due to completion St. Lawrence Waterway. $362,000. Address City Clerk.

Ia., Sioux City—City surveys Perry Creek Channel improvement. $25,000. L. Hintgen, Sioux City, engr.

Mass., Barnstable—W. D. Kilpatrick, Centerville, stone jetty, fill solid, Centerville River, $25,000. Private plans.

Ont., Toronto—Toronto Harbour Comrs., Harbour Bldg., completing ship channel wall, concrete on wood piles, sheet piling, $220,000. J. G. R. Wainwright, Harbour Bldg., engr.

CONTRACTS AWARDED

Calif., Los Angeles—Bd. Supervs., Los Angeles Co., Unit 1, San Gabriel River Outlet at Alamitos Bay, incl. jetties, bulkheads, furnishing rock, to Merritt-Chapman & Scott, 720 Wilmington Ave., San Pedro, $71,725; 136,000 cu.yd. fill for levee on San Gabriel River between Washington St. and Southern Pacific R.R., also placing 10,000 lb. drainage culverts, to Lewis Constr. Co., 210 South Vermont Ave., $13,428; 550,000 sq.ft. guniting levee slopes on San Gabriel River between Washington St. and Southern Pacific R.R., also 378,000 sq.ft. pre-cast concrete block toe-mat, miscellaneous work, district to furnish 10,000 bbl. cement, f.o.b. site, 353,600 lb. reinforcing bars cut and bent, to California Gunite Constr. Co., 1006 North Sycamore Ave., $57,484; channel protection work on San Jose Creek from Genesha Park to Pomona-Covina Rd., incl. 40,500 cu.yd. channel excav., 23,500 lin.ft. 58 in. pipe and wire protection, 900 lin.ft. 34 in. wire fencing, 500 lin. ft. placing brush between 58 in. fencing, 450 lin.ft. placing brush filler between 88 in. fencing, to Oberg Bros., 707 San Fernando Bldg., $13,245; 2 telephone lines from Sawpit Dam to Sierra Madre, to J. L. Bunch, 1645 Gernert St., Rosemead, $2,000. Grand total $157,882. Noted Aug. 27.

Pa., Titusville—Amer. Petroleum Institute, W. R. Boyd, Jr., chn. building com., 250 Park Ave., New York, dike, 1,800 ft. high, 40 ft. at base, earthfill stone faced on creek side, 12,000 cu.yd. fill and excav., near here, to Jamieson & Knapp, Fredonia, $13,000. Total est. $60,000.

Bond Elections

Coming Bond Elections

Additional Water Supply System — Hartford County Metropolitan Dist. Comn., Hartford, Conn., Nov. 3, $8,600,000.
School—Valley Stream, N. Y., Nov. 9, $450,000.
Senior High School — Conneaut, O., Nov. 3, $150,000.
Electric Light Plant — Eaton, O., Nov. 3, $330,000.

Bonds Voted

Waterworks—Hobart, Okla., $250,000. W. R. Holway, Tulsa, engr.
Sewers and Disposal Plant — New Richmond, Wis., $44,000.
Gas Distribution System — Wellington, Tex., $65,000.
School—Longview, Tex., $175,000.

Bonds Defeated

Sewers—East McKeesport, Pa., $30,000.
Irrigation Work—Linden, Calif., Linden Irrigation Dist., $93,000.

FEDERAL GOVERNMENT

PROPOSED WORK

Alabama—DREDGING—U. S. Eng., Montgomery, 4,027,000 cu.yd. in Pensacola Mobile Intracostal Waterway from mouth Portage Creek to 9 ft. contour in Bon Secours Bay.

Missouri—REVETMENT, etc.—U. S. Eng., Kansas City, improving Missouri River between mouth and Kansas City and between Kansas City and Sioux City, providing 6 ft. channel secured by bask revetment, permeable dikes to contract and rectify waterway. $190,000 allotted.

Pa., New Castle—POST OFFICE—Treas. Dpt. at office Sup. Archt., 1 story, basement, brick, steel, Washington, Diamond, Jefferson and Market Sts. $525,000. Noted Apr. 16.

Texas—DREDGING—U. S. Eng., Galveston, soon takes bids dredging portions waterway from near High Island to Galveston Bay near Pt. Boliver. $90,000 or more.

BIDS ASKED

Calif., Colusa—WEIR, etc.—Oct. 20, by U. S. Eng., Calif. Fruit Bldg., Sacramento, concrete weir with apron and abutment walls, cobblestone revetment of approach slope and talus of weir near Moulton Landing, Sacramento River. $75,000. Noted Aug. 12.

Calif., San Francisco—FILLING LINES, etc.—Oct. 21, by 12th Naval Dist., 100 Harrison St., fuel oil filling and distributing lines at Receiving Station, Yerba Buena Island, San Francisco Bay.

Conn., New London—RADIO TOWER—Spec. 6619—Oct. 21, by Yards & Docks, Navy Dpt., steel radio tower.

Conn., Waterbury—ELEVATOR PLANT, etc.—Oct. 26, by Treas. Dpt. at office Sup. Archt., elevator plant, heating, plumbing, electrical work in U. S. Post Office.

Conn., Waterbury—POST OFFICE—Oct. 26, by Treas. Dpt. at office Sup. Archt., brick, stone, Grand St. $570,000. Noted Feb. 26.

D. C., Wash.—STORAGE BUILDING, etc.—Oct. 20, by U. S. Eng., 1068 Navy Bldg., storage and shop buildings, both steel, also founds., floors, brick end walls for same on U. S. Reservation, at 11th and O Sts., S. E.; adv. E.N.-R. Oct. 15. Noted Sept. 24.

Fla., Lake City—WATER SUPPLY SYSTEM—Oct. 27, by Vet. Bu., Arlington Bldg., water supply system.

Ga., Fort Benning—ELECTRIC DISTRIBUTION SYSTEM—Oct. 29, at office Con. Q.M., underground electric distribution system for 33 houses in hospitl group; adv. E.N.-R. Oct. 15.

Ind., Indianapolis—COAL BUNKER—Oct. 20, by Vet. Bu., Arlington Bldg., coal bunker with rolling doors, rein.con., hollow tile, at U. S. Veterans' Hospital, Myers Rd. and 20th St. $25,000.

Minn., St. Paul—CLEARING—Oct. 30, by U. S. Eng., 615 Commerce Bldg., clearing 5,139 acres land lying in pool area above Mississippi River Lock and Dam 2, at Hastings. To exceed $15,000. Noted Oct. 1.

N. H., Manchester—POST OFFICE—Oct. 28, by Treas. Dpt. at office Sup. Archt., 2 story, basement, 95 x 145 ft. post office, incl. heating, plumbing, electrical work, freight elevator. $270,000.

O., Cleveland—POST OFFICE—Treas. Dpt. at office Sup. Archt., bids about Jan. 1, general contract 5 story, basement, stone, steel, concrete, 238 x 416 ft. site on Huron Rd., Prospect Ave., West 3rd and West 6th Sts. $5,275,000. Walker & Weeks, 2341 Carnegie Ave. and P. L. Small, Inc., Terminal Tower, assoc. archts. Noted July 9.

O., Fairfield—HANGAR—Oct. 27, by Con. Q.M., Wright Field, Dayton, air corps hangar, at Fairfield Air Depot; adv. E.N.-R. Oct. 15.

Pa., Altoona—POST OFFICE—Oct. 26, by Treas. Dpt. at office Sup. Archt., U. S. Post Office. Former bids rejected. Noted Oct. 8.

Pa., Pittsburgh — WOOD NEEDLE FLAT — Oct. 23, by U. S. Eng., 12 x 48 x 3 ft. 2 in. wood needle flat; adv. E.N.-R. Oct. 15.

S. C., Columbia—HOSPITAL—Nov. 10, by Vet. Bu., Arlington Bldg., buildings, utilities, incl. roads, walks, grading at Veterans' Administration Hospital; adv. E.N.-R. Oct. 15.

Texas—DREDGING, etc.—Nov. 4, by U. S. Eng., Galveston, 3,251,000 cu.yd. Galveston Channel, redredging 1,000,000 cu.yd. material in channels from Galveston Harbor to Texas City; adv. E.N.-R., Oct. 15. Noted Oct. 8.

Wis., LaCrosse—EXTENDING, etc.—Nov. 5, by Treas. Dpt. at office Sup. Archt., extending, remodeling U. S. Post Office, Court House; adv. E.N.R. Oct. 15.

Ont., Ottawa—OFFICE—Oct. 26, by Foreign Service Buildings Office, State Dpt., Wash., D. C., U. S. Office Building. $300,000. Noted Aug. 27.

CONTRACTS AWARDED

Ala., Mobile—GENERATOR SET—U. S. Eng., 1 diesel engine electric generator set, to Cooper-Besemer Corp., Grove City, Pa., $6,517. Noted Aug. 13.

D. C., Wash.—FOUNDATIONS—Dpt. Justice, found. for Department Justice, to S. M. Siesel Co., 502 Flannery Bldg., Pittsburgh, Pa., $949,000. Noted Sept. 3.

D. C., Wash—SENATE OFFICE BUILDING—D. Lynn, archt. Capitol, general contract 1st Street Wing Senate Office Building, to G. A. Fuller, Co., Munsey Bldg., $2,197,000. Noted Aug. 20.

Fla., Miami—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to R. Sollet & Sons, 223 La Salle St., Chicago, Ill., $1,032,472. Noted Aug. 27.

Ill., Rock Island—LEVEE—U. S. Eng., Rock Island, 957,000 cu.yd. levee work in Mississippi River, Indiana, Grove Levee Dist., to Wapello Constr. Co., Wapello, Ia., $47,693; to Clarence Miller, Keokuk, Ia. $24,280 to Matthew Bros. Constr. Co., Erie, Ill., $62,966. Grand total $134,939.

Ky., Harlan—POST OFFICE—Treas. Dpt. at office Sup. Archt., 2 story, rein-con., brick to C. Westberg, 6234 Oakley Ave., Chicago, Ill., $56,572. Noted Sept. 3.

Michigan—DREDGING—U. S. Eng., Detroit, Mich., 3,704,300 cu.yd., from St. Mary's River, to R. A. Perry, 233 Bway., New York, $318,569. Noted Sept. 3.

Mich., Ironwood—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to Smith Constr. Co., Builders Exch. Bldg., Duluth, Minn., $102,886. Noted Aug. 6.

N. Y., New York—MAIL HANDLING EQUIPment—Treas. Dpt. at office Sup. Archt., mail handling equipment in U. S. Parcel Post Building, to Logan Co., Inc., Franklin and Buchanan Sts., Louisville, Ky., $329,777.

Oregon—ROAD—W. H. Lynch, dist. engr., Custom House, Portland, improving 4.5 mi. road around Crater Lake, Crater Lake Natl. Park, 18 ft., to McNutt & Pyle, Eugene, $23,675.

Pa., Phila.—PIER, etc.—Spec. 6654—Yards & Docks, Navy Dpt., removing pier and dredging at Navy Yard, to National Dredging Co., 233 Bway., New York, $13,500. Noted Sept. 24.

S. D., Milbank—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to M. C. Manis Constr. Co., 979 Iglehart Ave., St. Paul, Minn., $53,800. Noted Aug. 20.

Tex., Wichita Falls—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to H. W. Underhill Constr. Co., Constr. Indus. Bldg., Dallas, $397,963. Noted Sept. 3.

Washington — ROAD — W. H. Lynch, dist. engr., Portland, Ore., grading, grade rails on 3.88 mi. road in Wenatchee Natl. Forest, to F. G. Redmon, Yakima, $30,009.

FEDERAL POWER COMMISSION

Applications for License and Permits Licenses

1172—C. O. Lenz, M. Hellstrom and A. J. Brady, New York, wants preliminary permit power development on Columbia River, at Cascade Locks in Skamania Co., Wash., and Hood River Co., Ore.

1173—R. M. Foster, Bridgeport, Calif., wants license small power development on Spring Creek, within Mono Natl. Forest, Mono Co.

1174—Boss Tweede-Clipper Gold Mines, Inc., Butte, Mont., wants licefse transmission line on public lands within Madison Natl. Forest, Madison Co.

1175—Kanawha Valley Power Co., Charleston, W. Va., wants license power development on Kanawha River in Kanawha Co.

1176—Yellow Pine Co., Boise, Idaho, wants license power development on East Fork of South Fork Salmon River, Valley Co., within Idaho Natl. Forest.

RAILWAYS

BIDS ASKED

British Columbia—See "Contracts Awarded."

CONTRACTS AWARDED

Pennsylvania—See "Grade Crossings" under Glenshaw.

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Railways (Continued)

British Columbia—Provincial Govt., Victoria, extending 75 mi. Pacific Great Eastern Ry. from Quesnel to Prince George. $3,000,000. Dominion Govt. paying half cost. Most of work to be done by day labor under supervision Government Engineers. C. R. Grysdale, Dpt. Rys., Victoria, ch. engr.

SUBWAYS AND TUNNELS

PROPOSED WORK

N. Y., New York—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., preliminary plans tunnel from 10th Ave., New York, to Long Island City, along 37th and 38th Sts. $93,000,000. **Maturity in spring.** City to appropriate $200,000 for studies, plans and specifications. Noted Jan. 8.

GRADE CROSSINGS

PROPOSED WORK

N. J., Clifton Park—Delaware & Hudson R.R. Co., J. MacMartin, ch. engr., Albany, and Boston & Maine R.R. Co., W. J. Backes, ch. engr., Boston, Mass., by, approaches in connection with eliminating Elnora and Dyers Crossings. $55,300.

N. J., South Plainfield—Lehigh Valley R.R. Co., G. T. Hand, 143 Liberty St., New York, steel, concrete grade crossing elimination at Park Ave. $180,000. **Maturity probably soon.** This corrects report in Oct. 1 issue.

N. Y., Horseheads—Erie R.R. Co., G. S. Fanning, ch. engr., 101 Prospect Ave. S.W., Cleveland, O., and Delaware, Lackawanna & Western R.R. Co., G. J. Ray, ch. engr., Hoboken, N. J., eliminating grade crossings here and at Big Flats. $53,800.

N. Y., Whitehall—Delaware & Hudson R.R. Co., J. MacMartin, ch. engr., Albany, eliminating Boardman, Main, Church and Bellamy St. Grade Crossings. **Maturity after December.**

BIDS ASKED

Michigan—See "Bridges."

New York—See "Bridges."

CONTRACTS AWARDED

N. J., New Providence—Delaware, Lackawanna & Western R.R. Co., G. J. Ray, ch. engr., Hoboken, by, bridge to carry Springfield Ave. over railroad tracks, to Roberts & Schafer Co., 400 North Michigan Ave., Chicago, Ill.; 31 tons reinforcing steel, to Truscon Steel Co., Harrison; grading, sidewalks, drains, rein.-con. paving 6,000 sq.yd. Springfield Ave., to Osborne & Marsellis, Bellevue Ave., Upper Montclair. Noted Oct. 1.

N. Y., Chateaugay—Delaware & Hudson R.R. Co., J. MacMartin, ch. engr., Albany, eliminating Willsboro and Jacobs Crossings, to Spellman & Oliver, Chateaugay.

N. Y., Islip—Long Island R.R. Co., A. C. Watson, ch. engr., Pennsylvania Station, New York, eliminating Carleton Ave. crossing 1 mi. east of Islip station, to Good Roads Eng. & Constr. Co., Inc., 250 Fulton St., Hempstead, $51,122. Est. $88,307.

N. Y., Southampton—Long Island R.R. Co., A. C. Watson, ch. engr., Pennsylvania Station, New York, reconstructing railroad bridge carrying railroad over North Sea Road Hy., to Good Roads Eng. & Constr. Co., Inc., 250 Fulton St., Hempstead, $16,377. Est. $27,570. Noted Oct. 31, 1929.

Pa., Glenshaw—Baltimore & Ohio R.R. Co., Baltimore, Md., H. A. Lane, ch. engr., relocating main tracks at connection with grade crossing elimination Wittmer and Mt. Royal Baltimore & Ohio tracks, incl. 300,000 cu.yd. excav., 785 lin.ft. 18- to 48-in. rein.-con. pipe, to Vang Constr. Co., Grant Bldg., Pittsburgh.

DAMS

BIDS ASKED

Tex., Corpus Christi—See "Waterworks."

PIERS AND WHARVES

PROPOSED WORK

Miss., Gulfport—PIER, etc.—City, Harrison Co. and State, pier, ship slips, wharves, warehouse, in harbor development. $1,000,000.

N. Y. Brooklyn—PIER, etc.—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, rejected bids Sept. 4, constructing pier and piershed, foot Cranbury St. Noted Sept. 3.

BIDS ASKED

N. Y., New York—PIERS—Oct. 22, by Dpt. Docks, Pier "A" Battery Pl., substructure for long piers at 48th, 50th and 52nd Sts. $6,000,000. Noted May 21.

AIRPORTS

PROPOSED WORK

Okla., Oklahoma City—City, M. Peshek, clk., preliminary plans new hangar at municipal airport. $30,000. W. E. Fletcher, Oklahoma City, engr.

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POWER AND LIGHTING

PROPOSED WORK

New Jersey—Hudson Co. Park Comn., 921 Bergen Ave., Jersey City, preliminary plans furnishing, installing traffic lighting system on Hudson Co. Blvd. at Veterans Sq., Jersey City and Bayonne, $25,000 or more. F. J. Radigan, Court House, Jersey City, engr.

CONTRACTS AWARDED

Calif., Los Angeles—Ornamental lighting system, incl. underground system, 3rd St., to Newbery Electric Corp., 726 South Olive St., $84,451.

Wash., Seattle—S. J. Humes, dir. Hys., Olympia, electric lighting system for Lake Union Bridge, approaches, to J. J. Agutter & Co., 316 Seneca St., $21,829. Noted Sept. 17.

PARKS AND SPORTS

PROPOSED WORK

Calif., Claremont—See "Schools."

Mass., Lincoln—Town, G. Garbell, chn. Bd. Selectmen, John J. Pierce Park and Playground, Engineer not appointed.

Mass., Taunton—Owner, c/o E. W. Poole, archt., Chapman Bldg., New Bedford, soon takes bids 1 story men's locker building, brick, concrete. $25,000-$30,000.

N. J., Jersey City—Madison Square Garden Corp., W. F. Carey, pres., 808 West 50th St., New York, creosoted lumber and concrete arena, 70,000 seating capacity. $250,000. Engineer not appointed.

N. J., Woodbridge—Twp. Comn., Township Hall, preliminary plans playground, wading pool $25,00. G. R. Morrill, Twp. Hall, engr.

N. Y., New York—Dpt. Parks, W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, and Office, S. Levy, pres. Manhattan Boro, Municipal Bldg., seeking options on sites for 12 park playgrounds. $9,000,000.

N. Y., Port Richmond—Staten Island Baseball Club, c/o M. T. Gordon, Jr., 735 Richmond Rd., 1 story, steel, concrete baseball stadium, 18,000 seating capacity, Forest and Decker Aves. $25,000. C. A. Duke, 11 West 42nd St., New York, engr.

BIDS ASKED

N. Y., Kings Park—Oct. 20, by Long Island State Park Comn., Administration Headquarters, Belmont State Park, Babylon, bathhouse, plumbing in Sunken Meadow State Park, Suffolk Co. A. E. Howland, ch. engr.; adv. E.N.-R. Oct. 15.

HEATING AND VENTILATING

PROPOSED WORK

Pa., Cresson—Cresson State Sanitarium, gas main, water lines, boiler and stoker. $50,000. C. A. Blatchley, Drexel Bldg., Phila., engr.

BIDS ASKED

N. J., New Lisbon—Oct. 16, by Dpt. Institutions & Agencies, State Office Bldg., Trenton, installing steam distribution lines at State Colony for Feeble Minded Males. $25,000. Div. Architecture & Constr., State Office Bldg., Trenton, engr.

CONTRACTS AWARDED

Ind., Hartford City—See "Power Plants."

UNCLASSIFIED

PROPOSED WORK

N. J., Morristown—BROOK ENCLOSURE—Bd. Town Council, Town Hall, enclosing Coryc's Brook from Alno Ave. to Washington St., $50,000. **Maturity probably soon.** C. R. Fetzler, South St., town engr.

N. J., Ocean City—BULKHEAD, etc.—C. G. DuBell Lumber Co., 18th and Federal Sts., preliminary plans timber bulkhead and piers on bayfront, 2nd St. $25,000. W. H. Collison, City Hall, engr.

New York, N. Y.—GASOLINE PIPE LINE—Sun Pipe Line Co., c/o Sun Oil Co., 1608 Walnut St., Phila., Pa., 40 mi. gasoline pipe line from Syracuse to point on Lake Ontario. **Maturity indefinite.**

BIDS ASKED

Conn., New Haven—LABORATORY—Oct. 19, by Conn. Agricultural Experimental Station, W. L. Slate, Huntington Rd., brick laboratory known as Jenkins Laboratory, Huntington Rd. $50,000. D. Orr, 956 Chapel St., archt.

N. Y., Brooklyn—STATION FINISH WORK—Oct. 23, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, station finish work for Smith-9th St. and 4th Ave. Stations Rapid Transit R.R.

CONTRACTS AWARDED

Calif., San Francisco—PIER SHED—California State Harbor Comn., Ferry Bldg., 110 x 830 ft. pier shed, precast concrete wall slabs, asphalt and gravel covered roofing, Pier 23, to Barrett & Hilp, 918 Harrison St., $92,648. Noted Apr. 23.

Mass., Boston—COAL POCKETS—Morgans, Inc., 1010 Massachusetts Ave., Roxbury, 2 coal pockets, 1022 Massachusetts Ave. to Nicholson Co., Chrysler Bldg., New York.

N. J., Newark—DOCK—Passaic Valley Sewerage Comn., 24 Branford Pl., reinforcing dock at Newark front, to A. N. Spooner & Son, foot Clarenmont Ave., Jersey City, $44,810. Noted Sept. 8.

N. Y., Brooklyn—FOUNDATIONS, etc.—Casino Realty Corp., c/o T. H. Beardsley, 61 Wall St., New York, founds., excavation for club, Montague and Hicks Sts., to John Thatcher & Son, 60 Park Ave.

N. Y., New York—BLOCK SIGNAL SYSTEM, etc.—Bd. Transportation, J. H. Delaney chn., 250 Hudson St., block signaling and interlocking equipment for Independent System City-owned subways to General Railway Signal Co., 230 Park Ave., $2,371,800. Noted Sept. 3.

N. D., Dickinson—COALING STATION—Northern Pacific Ry. Co., B. Blum, ch. engr. Railroad Bldg., St. Paul, Minn., timber superstructure coaling station, to Peppard & Fulton Co., 1110 Wesley Temple Bldg., Minneapolis, Minn. Total est. $50,000. Foundation completed.

Pa., Phila.—GAS HOLDER—Philadelphia Gas Wks., 1401 Arch St., 10,000,000 cu.ft. capacity, five lift water-sealed gas holder, to McClintic-Marshall Corp., Bethlehem.

Utah, Logan—GREENHOUSES—State Building Comn., Salt Lake City, 2 greenhouses for Utah Agricultural College to J. Mickelson, Logan, $14,173; boiler and stoker, to K. Bachman & Son, Logan, $6,601. Noted Sept. 22.

Vt., Newport—TOWER and PENSTOCK—Newport Electric Light Co., W. J. Read, Newport, surge tower steel, to Chicago Bridge & Iron Co., 37 Van Buren St., Chicago, Ill.; excav. and construction, to J. M. Swan & Son, St. Johnsbury. Est. exceeds $25,000.

MATERIALS

BIDS ASKED

BRIDGE LUMBER, etc.—**Harlan, Ia.**—Oct. 19, at office Auditor Shelby Co., bridge lumber, piling, miscellaneous hardware paint, corrugated culvert pipe. Address County Engineer or Auditor, Harlan.

STEEL—**Annandale, N. J.**—Dpt. Institutions & Agencies, State Office Bldg., Trenton, taking bids furnishing, delivering structural steel, ornamental iron, millwork, roof slab and slate, hardware, 800 bbl. cement, for administration building. $25,000. Div. Architecture & Constr., Trenton, engrs.

STEEL—**Preakness, N. J.**—Oct. 28, by Bd. Freeholders Passaic Co., Court House, Paterson, furnishing, installing structural steel laundry equipment, water and sewer mains for Welfare Detention Home. $75,000. F. J. Vreeland, 140 Market St., Paterson, engr.

ROAD OIL—**Trenton, N. J.**—Oct. 22, by State Purchasing Comn., State House, 43,250 gal. asphaltic oil Grade HK or tar Grade UC or KP. $5,000 or more.

STEAM ASHES—**Long Island City, N. Y.**—Oct. 21, by G. U. Harvey, pres. Queens Boro Queens Subway Bldg., 16,000 cu.yd. steam ashes.

LUMBER, etc.—**New York, N. Y.**—Oct. 19, by P. J. Dooling, comr. Purchase, Municipal Bldg., lumber and railroad ties to Dpt. Parks—Brooklyn, Plant & Structures, and Sanitation.

CABLE and FIRE HYDRANTS—**Cleveland, O.**—Oct. 16, by City, lead covered steel taped Parkway cable, lead covered cable and fire hydrants.

CONTRACT AWARDED

STEEL PIPE—**San Francisco, Calif.**—L. S. Leavy, city purch. agt., to Daldiel-Moller Co., 1666 Mission St., furnishing, delivering standard weight galvanized wrought steel pipe for Municipal Water Dpt., 1,000 ft. ¾ in. at $4.83 per 100 ft., 25,000 ft. ¾ in. $5.90, 2,000 ft. 1 in. $8.41, 3,000 ft. 1¼ in. $13.60.

ALUM—**Minneapolis, Minn.**—F. S. Gram, city purch. agt., 5,000 tons alum for filtration plant, to General Chemical Co., 300 West Adams St., Chicago, Ill. at $1.22 per cwt.

ASPHALTIC MACAM BINDER—**St. George, N. Y.**—J. A. Lynch, pres. Richmond Boro, Boro Hall, 62,000 gal. asphaltic binder, to Vanbro Constr. Co., 24 Elizabeth St., West New Brighton, $2,728. Noted Sept. 24.

PIPE—**Milwaukee, Wis.**—City, 24- to 54-in. pipe, to U. S. Cast Iron Pipe & Fdry. Co., 760 East Pearl St., Burlington, N. J., $72,082.

EQUIPMENT

PROPOSED WORK

WATER METER—**Beverly Hills, Calif.**—B. J. Firminger, city clk., rejected bids Sept. 15, furnishing recording water meter carbonizing equipment for Municipal Water Dpt. Will take new bids on revised plans for water meter carbonizing will be done by city forces.

BIDS ASKED

PAPER and PULP MILL MACHINERY, etc.—**Savannah, Ga.**—C. H. Herty, engr., 101 Park Ave., New York, taking bids machinery and equipment for paper and pulp mill, for State Dpt. of Forestry & Geological Development, Capitol Bldg., Atlanta. Noted Sept. 3, under "Factories and Mills."

BORING MILL, etc.—**Detroit, Mich.**—Dpt. Street Railways, St. Jean and Shoemaker Aves., in market vertical boring mill, pipe threading machine, power feed rip saw, mitre saw.

TRUCK, etc.—**Grand Rapids, Minn.**—Oct. 20, by T. Erskine, aud. Itasca Co., 3.5 ton 8 cylinder truck of 3 cu.yd. body (bids are asked to purchase, rent with privilege of later purchase or rent only), $6,500. H. A. Sueur, Grand Rapids, co. hy. engr.

Equipment (Continued)

CONDENSER—**New York, N. Y.**—Oct. 19, by Dpt. Hospitals, J. G. W. Greeff, comr. Dpt. Hospitals, Municipal Bldg., surface condenser in power house at Bellevue Hospital.

SNOW BROOMS—**New York, N. Y.**—Oct. 19, by P. J. Dooling, comr. Purchase, Municipal Bldg., motor-driven snow brooms to Dpt. Sanitation.

CONTRACTS AWARDED

OIL PUMP, etc.—**Boston, Mass.**—City, Hospital Dpt., furnishing oil pump and heating equipment for power plant, Boston City Hospital, to J. J. Hurley & Co., 104 Bway., $9,215. Noted Sept. 17.

DIESEL OIL ENGINE, etc.—**Ford City, Pa.**—City, one 500 kw. Diesel oil engine and generator, to Nordberg Mfg. Co., East Oklahoma and Chase Aves., Milwaukee, Wis., $33,650. Noted Sept. 3.

FOREIGN

Egypt, Cairo—Oct. 22, by Director General Tanzim Dpt. supplying water meters.

New Zealand, Invercargill—Oct. 28, by City Clerk, 1 centrifugal low-lift pumping plant, with motor and control gear.

New Zealand, Wellington—Nov. 10, by Secretary Posts & Telegraphs Dpt., 5,650 condensers and 2,300 lamp caps.

New Zealand, Wellington—Nov. 11, by Secretary Posts & Telegraphs Dpt., considerable number time-delay relays.

South Africa, Johannesburg—Nov. 16, by General Manager South African Rys. & Harbours, supply of copper and steel plates for locomotive boilers.

Commercial Buildings

RESIDENTIAL

BIDS ASKED

N. J., West Orange—Robert Paterson, Inc., 116 Market St., Newark, taking bids general contract 5 story, 100 x 115 ft., brick, steel, Washington St. $200,000. Former separate contract bids rejected. Harris & Sohn, 17 Mechanic St., Newark, archts. Noted Sept. 17.

N. Y., Bayside—See "Contracts Awarded."

N. Y., New York—See "Contracts Awarded."

N. Y., Queens Village — See "Contracts Awarded."

N. Y., St. Albans—See "Contracts Awarded."

N. Y., White Plains—Willnath Operating Co., Mount Vernon, or c/o Cherry & Matz, archts., 232 Madison Ave., New York, general and separate contracts in March, apartment, Bway, Parkway and Windsor Terrace. To exceed $150,000.

CONTRACTS AWARDED

N. Y., Bayside — Kings Builders, Inc., 66 Court St., Brooklyn, 2 story, basement, brick, steel, 217th St. and 48th Ave., separate contracts. $150,000. B. Dreisler, Jr., 153 Remsen St., Brooklyn, archt.

N. Y., Long Island City—Granoff Homes, Inc., 2458 84th St., Brooklyn, 2 story, 47th St. and 25th Ave., separate contracts. $160,000. A. Farber, 153 Remsen St., Brooklyn, archt.

N. Y., New York—Corporation, c/o J. M. DeLisa, 2726 Pearsall Ave., 6 story, Mayflower Ave. and 197th St., separate contracts. $150,000. A. E. Schaefer, 2408 Grand Concourse, archt.

N. Y., New York—Olinwest Realty Corp., N. Botwin, pres., 337 East 149th St., 4 story, 196th St. and St. Paul Ave., separate contracts, $150,000. I. L. Crausman, 332 East 149th St., archt.

N. Y., New York—Racklin & Fagin Constr. Co., 1539 Undercliffe Ave., 6 story, 107 x 274 ft., Undercliffe Ave. and 176th St., separate contracts. $450,000. C. Kreymborg, 2534 Marion Ave., archt.

N. Y., New York—Richon Realty Corp., 577 Walton Ave., 6 story, 100 x 118 ft, 242nd St. and Richardson Ave. separate contracts. $190,000. J. P. Boyland, 305 Kingsbridge Ave., archt.

N. Y., New York—Real Properties, Inc., 1975 Lafontaine St., 6 story, 85 x 125 ft., DeKalb Ave. and 212th St., separate contracts. $225,000. Becker & Levy, 349 East 149th St., archts.

N. Y., New York—Two Hundred Eight East 201st Street Corp., D. Messuri, pres., 150 Nassau St., 6 story, 201st St. and Grand Concourse, separate contracts, $150,000. L. L. Crausmann, 332 East 149th St., archt.

N. Y., New York—Yorkly Realty Corp., 119 West 40th St., 18 story, 77 x 146 ft. 445 East 34th St., separate contracts. $1,000,000. E. Roth, 1440 Bway., archt. Noted Oct. 1.

RES.

N. Y., Queens Village—Cornelia Constr. Co., 220 West 42nd St., New York, 6 story, Cornelia St. and Wyckoff Ave., separate contracts, $150,000. Malkind & Weinstein, 93 Court St., Brooklyn, archts.

N. Y., St. Albans—Masterbilt Homes, Inc., 220th St. and Foch Blvd., Jamaica, 2 story, basement, brick, steel, 220th St. and 115th St. Rd., separate contracts. $150,000. J. Cahill, 155-28 Jamaica Ave., Jamaica, archt.

HOSPITALS

PROPOSED WORK

Conn., Greenwich—Town, William St., plans by W. B. Tubby, 475 5th Ave., New York, 3 story, steel hospital addition and alterations, Parsonage Rd. $150,000.

Mass., Westfield—Noble Hospital, 105 West Silver St., plans by M. B. Harding, 10 Main St., Lilley Memorial Children's Unit, 4 story, 50 x 125 ft., brick, steel, West Silver St. $250,000. Action deferred until 1932.

Ill., Anna—Anna State Hospital for Insane, O. J. Hagebush, supt., sketches by C. H. Hammond, supervy. archt., Capitol Bldg., Springfield, concrete, brick additions, incl. recreation and amusement hall, $75,000, occupational therapy building $25,000; kitchen, equipment $50,000, 5 bungalows for physicians $34,000, repairing existing buildings $50,000.

N. J., Belvidere—Joint Bd. Freeholders Somerset, Warren, Sussex, Morris and Hunterton Counties, Court House, 2 story, basement, brick, steel tuberculosis sanitorium, $150,000. **Maturity probably soon.** Architect not appointed.

N. J., Long Branch—E. C. Hazard Hospital, E. C. Hazard, doctor, 81 Washington St., 12 story, basement, 150 x 200 ft., brick, steel, Washington Ave. and Dewey St. $1,000,000. **Maturity probably in January.** C. C. Hartmann, Greenburgh, N. C., archt. Noted Oct. 1.

Pa., Torrance—Commonwealth of Pennsylvania, Torrance State Hospital, C. R. McKinnis, supt. sketches by B. H. Prack, 119 Federal St., Pittsburgh, brick, steel dining room and kitchen, $173,618. G. T. Titzel, Butler County Natl. Bank Bldg., Butler, engr. Noted July 9.

BIDS ASKED

Calif., San Francisco—Oct. 28, by S. J. Hester, secy. Bd. P. Wks., plumbing for Health Center Building, $55,000, mechanical equipment $45,000, electrical work $50,000, elevators $20,000, for City and Los Angeles Co. Noted Oct. 1.

N. Y., Long Island City—Oct. 19, by Dpt. Hospitals, J. G. W. Greeff, comr., Municipal Bldg., New York, constructing Buildings A, B, C, E, F, G, and H, Queens General Hospitals, 164th St. between Goethals Ave. and Grend Central Parkway.

CONTRACTS AWARDED

Conn., Willimantic—St. Joseph's Hospital, 88 Jackson St., altering 3 story, basement, brick, hospital and nurse's home, to H. Wales Lines Co., 309 State St., New London. Noted Sept. 10.

Pa., Erie—Hamot Hospital, F. W. Brouff, acting dir., 4 East 2nd St., 6 story, 43 x 107 ft., brick, limestone, steel to H. Shenk Co., 12th and Sassafras Sts. Est. $200,000. Noted July 23.

CHURCHES

PROPOSED WORK

Mass., Randolph—Trinity Episcopal Church preliminary sketches by C. C. Coneney, 184 Boylston St., Boston, 1 and 2 story, basement church, parish house. $1,500,000.

Mass., Weymouth—Trinity Episcopal Church, W. Hyde, pastor, plans by C. C. Coveney, 184 Bolyston St., Boston, and taking preliminary estimates 1 and 2 story, basement, granite, stucco, plain found. $150,000 or more.

N. J., Essex Fells—St. Peter's Episcopal Church, Roseland Ave., sketches by Goodwillie & Morgan, 56 West 45th St., New York, 2 story, basement, brick, stone, steel church, parish house, parsonage. $200,000.

N. J., Orange—Baptist Church, M. Lewis, pastor, 387 Cleveland St., 2 story, basement, brick, steel church. $150,000. **Maturity probably soon.**

O., Cleveland—First Church of Christ Scientist of Cleveland Heights, W. H. Jackson, chn. building com., Union Trust Bldg., plans by R. M. Johnson, B. F. Keith Bldg., 1 story, brick, stone, Fairmount Blvd. and Lee Rd. $250,000.

BIDS ASKED

Mass., Leicester—St. Joseph's Parish, 763 Main St., taking bids 3 story, brick, stone convent for Sisters of Mercy. $150,000. J. W. Donohue, 1200 Main St., Springfield, archt. Noted Oct. 1.

R. I., Providence—St. Mathews Roman Catholic Parish, c/o A. J. Murphy, archt., 25 Fenner St., taking bids 1 and 2 story, basement, brick, stone church, school, Park and Elmwood Aves. $150,000.

CONTRACTS AWARDED

Conn., Waterbury — West Side Methodist Episcopal Church, R. F. Shinn, pastor, brick, stone, to Tracy Bros. Co., 52 Benedict St. Est. $150,000. Noted Sept. 3.

Mass., Framingham—Parker St. Baptist Church, F. Paul, pastor, 1 story, basement, brick, stone plain found. Parker St., to I. P. Rocheford, 24 Union Ave. Est. $150,000. Noted Oct. 1.

N. J., Passaic—St. Peter's & St. Paul's Polish Natl. Church, J. Wroblenski, pastor, 126 River Dr., general contract rebuilding 2 story, basement, brick, steel, to A. Grosek, 126 River Dr. Est. $150,000. Noted Oct. 1.

SCHOOLS

PROPOSED WORK

Calif., Claremont—Pomona College plans by Matson & Maybury, 25 South Euclid Ave., Pasadena, rein.-con., brick gymnasium, incl. dancing studio, rifle range, bowling alley. $150,000.

Calif., Fresno—State of California (State Teachers College) sketches by Swartz & Ryland, Brix Bldg., brick library. $175,000.

Calif., Los Angeles — City of Los Angeles School Dist. plans by Marsh, Smith & Powell, Architects Bldg., fireproof school addition, North Highland Ave. $150,000.

Calif., Los Angeles—City of Los Angeles School Dist. plans by A. S. Nibecker, Jr. c/o Bd. Educ., fireproof school addition, Towne Ave. $150,000.

Calif., Riverside — University of California, 3551 University Ave., plans by G. S. Wilson, 3646 9th St., 2 story basement, rein.-con. etymology building. $150,000.

Calif., Vallejo—Vallejo City School plans by Davis-Pearce, Inc., Builders Bldg., Stockton. Junior and Senior High School, brick, concrete, $230,000 voted. Noted Aug. 27.

Conn., Darien—Town School Bd., plans by J. N. Pierson, 198 Jefferson St., Perth Amboy, N. J., 2 story, basement, brick school, Glenbrook Sect. $150,000.

Del., Wilmington—State School Building Comm., Dover, plans by Guilbert & Betelle, 20 Branford Pl., Newark, N. J., altering and constructing 2 story, basement, brick, steel, rein.-con. addition to T. Bayard School, plain found. $250,000.

Mass., Chicopee—City, H. Cloutier, mayor, sketches brick steel school, Chicopee St. $200,000. Architect not appointed.

Mass., New Bedford—Mt. Carmel Roman Catholic Parish, A. P. Vieira, pastor, plans by H. Fallows, 131 Stewart St., Fall River, 2 story, basement school, $150,000, also convent, $50,000. Rivet and Bonney Sts. $200,000. Noted Sept. 17.

Mass., Pittsfield—Roman Catholic Diocese, T. O'Leary, bishop, 68 Elliot St., Springfield, plans by J. W. Donohue, 1200 Main St., Springfield, 3 story, 115 x 285 ft., brick, cast stone high school. $350,000. Awaiting funds. Noted Aug. 6.

Mass., Revere—City, School Dpt., plans by P. J. Brown, 51 Cornhill, Boston, altering and constructing 2 story, basement brick, addition to Paul Revere School. $150,000.

Mass., Roslindale (sta., Boston)—City of Boston, Dpt. School Bldgs., plans by H. R. Duffie, 364 Belgrade Ave., 2 story, basement, brick, stone, elementary school, plain found., Beech St. $150,000.

Mass., South Hadley—Mt. Holyoke College, M. E. Wooley, pres., c/o H. French, 210 South St., Boston, sketches by Cram & Ferguson, 248 Boylston St., Boston, chapel building, $2,000,000. **Maturity probably in 1933.** A. Shurcliff, 11 Beacon St., Boston, landscape archt. H. French, 210 South St., Boston, heating and plumbing engr.

Mass., Springfield—City, Z. E. Scott, supt. schools, brick, steel trade school. $350,000. Architect not appointed.

Mass., Springfield—St. Michael's Parish, G. A. L. Conner, pastor, 260 State St., brick high school. $150,000. **Maturity next year.** Architect not appointed. Noted Feb. 19.

Mass., Taunton—Catholic Diocese, Bishop J. E. Cassidy, Fall River, sketches by J. I. Higgins, Borden Blk., Fall River, Monseigneur Coyl Memorial High School, brick, steel. $150,000 or more.

Mass., Topsfield—Town, D. Phillips, chn. Bd. Educ., sketches by Kilham, Hopkins & Greeley, 9 Park St., Boston, brick, artificial stone grade and high school, Main St. $200,000. Noted Aug. 20.

Mich., East Lansing—Michigan State College, East Lansing, plans by Bowd & Munson, Lansing, 4 story, basement, brick, steel, concrete, stone dormitory, plain found., campus. $350,000.

Mich., Flint—Bd. Educ. plans by Malcolmson, Higginbotham & Trout, 1217 Griswold St., Detroit, 3 story, basement, 150 x 605 ft., brick, steel, rein.-con. high school, incl. gymnasium, auditorium, plain found. Est. $400,000.

N. H., Alstead—Town, A. Yaeger, Town Hall, sketches high school. $175,000. Architect not appointed.

N. H., Exeter—Phillips Exeter Academy, I. Perry, soon lets contract brick, limestone, steel dormitory. To exceed $150,000. Cram & Ferguson, 248 Boylston St., Boston, Mass., archts.

N. J., Denville—Joint Bd. Educ. Denville and Rockaway, Main Rd., 2 story, basement, brick, steel, rein.-con. high school State Hy. 6. $150,000. **Maturity probably soon.** Architect not appointed.

N. J., Elizabeth—Bd. Educ., 417 South Broad St., will not build 3 story, basement brick steel school, athletic field, stadium, Clarkson Ave. and Green Garden St. $150,000. Project abandoned. Noted Aug. 19.

N. J., Madison—Bd. Educ., G. F. Sutherland, pres., High School, 2 story, basement, brick steel rein.-con. high school addition, Main St. $150,000. **Maturity probably soon.** Architect not appointed.

N. J., Madison—Bd. Educ., G. F. Sutherland, pres. High School, Junior High School, 2 story, basement, brick, steel, rein.-con., Kings Rd. $250,000. **Maturity probably soon.** Architect not selected.

N. J., Oceanport—Bd. Educ., 2 story, basement, brick, steel, rein.-con. school addition $150,00. **Maturity probably soon.**

N. J., Sayreville—Bd. Educ., 419 Main St., will not build Junior High School, 2 story, basement. Project abandoned. $150,000 Noted June 25.

N. J., Springfield—Bd. Educ. revised sketches 2 story, basement, brick, steel, rein.-con. high school. $300,000. Noted July 23.

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Schools (Continued)

N. J., Spring Lake—Bd. Educ., 3 story, basement, brick, steel high school. $150,00, **Maturity in spring.** Architect not appointed. Noted July 20 Daily.

N. J., Trenton Junction—Dpt. Institutions & Agencies, State House Annex, Trenton, revised sketches by Guilbert & Betelle, 20 Branford Rd., State School for Deaf, 2 story, basement, brick, steel. $200,000.

Pa., Latrobe—St. Vincents Arch Abbey, Father Koch, in charge, plans by Link, Weber & Bowers, 407 North Craig St., Pittsburgh, 3 story, 60 x 150 ft., rein.-con., steel shop and dormitory. Est. $1'0,000.

R. I. Warwick—Town, W. A. Sherman, supt. schools, plans by W. R. Walker & Son, 49 Weybosset St., Providence, Junior and Senior High School, 2 story, basement, brick, steel, plain found., Apponaug Dist. $482,000.

R. I., Westerly—Roger Williams University plans by Woodbury & Stuart, 581 Boylston St., Boston, college group. To exceed $150,000.

Tex., San Antonio — Catholic Church, c/o A. Drosserts, pastor, 230 Dwyer St., purchased 5 acre plot and plans school, church in Woodlawn Hills. $200,000. Architect not appointed.

Vt., Northfield—Norwich University, H. Orser, treas., sketches brick dormitory. $150,000. Architect not appointed.

Ont., Toronto—Bd. Educ., 155 College St., plans by C. E. Dyson, 155 College St., new brick, concrete, steel, stone, marble, tile, collegiate institute. $250,000 or more.

Ont., Toronto—Bd. Educ., 155 College St., plans by C. Dyson, 155 College St., 3 story, basement, brick, stone, concrete, steel addition to Central High School of Commerce. $175,000.

Que., Montreal—Roman Catholic School Comn., 113 Ste. Catherine St. W., plans by H. S. Labelle, 620 Cathcart St., 3 story, 64 x 86 ft., concrete, brick, rein.-con. school for St. Roch Parish, Outremont Ave. $150,000.

Que., St. Martine—Provincial Dpt. P. Wks. soon takes bids 4 story, brick agricultural school, concrete found. $ 150,000.

BIDS ASKED

Del., Wilmington—Oct. 26, by State School Building Comn., D. D. V. Halloway, supt., Dover, altering and constructing 2 story, 102 x 190 ft., rein.-con., brick, steel addition, plain found., Maple, Clayton and DuPont Sts. $250,-000. Delaware School Found., Inc., DuPont Bldg., Dover, engrs. Guilbert & Betelle, 20 Branford Pl., Newark, N. J., archts.

Ill., Elgin—Bd. Educ. bids about Oct. 25, 2 story, ground floor, 150 x 158 ft., rein.-con., brick, terra cotta school, incl. steam heating, gymnasium, kindergarten, DuBois, Van and Shuler Sts. $150,000. W. B. Ittner, Inc., Continental Life Bldg., St. Louis, Mo., archts. Noted Aug. 6.

Ind., Angelo—School Comrs., bids about Dec. 1, 2 story, basement, 120 x 140 ft. rein.-con., brick, stone high school, $150,000. Pohlmeyer & Pohlmeyer, 260 Central Bldg., Ft. Wayne, archts.

Mass., Chatham—Town, E. B. Sampson, chn. taking bids 2 story, basement, brick, steel school addition, incl. gymnasium, Main St. $200,000. McLaughlin & Burr, 88 Tremont St., Boston, archts.

N. J., Kearney (sta. Arlington)—Oct. 16, by Bd. Educ., E. Stevenson, secy., Garfield School, general contract Roosevelt School, 3 story, basement, brick, steel, Kearney and Stewart Aves. $250000. Former bids rejected. Guilbert & Betelle, 20 Branford Pl., Newark, archts. Noted Oct. 8 under "Contracts Awarded."

N. J., Montclair—Nov. 10, by Bd. Educ., 22 Valley Rd., general contract altering and constructing 1 story, basement, brick, rein.-con., steel addition to Hillside School, Orange Rd. and Hillside Ave. $150,000. Starrett & Van Vleck, 393 7th Ave., New York, archts. Noted Oct. 1.

N. J., Morristown—Oct. 21, by Bd. Educ., O. M. Goble, dist. clk., 50 Early St., 2 story, basement, 160 x 175 ft. brick, steel rein.-con., Mills St. $300,000. C. C. Voorhees, 1 Schuyler Pl., archt. Noted Oct. 1.

N. J., Paterson—Bd. Educ., City Hall, bids about Dec. 1, School 18, 2 story, basement, brick, steel, rein.-con., East 18th St. $250,000. Fanning & Shaw, 49 Ward St., Paterson, archts.

N. J., Pompton Lakes—Bd. Educ., T. J. Hutton, dist. clk., 96 Perrin Ave., bids about Dec. 1, Senior High School, 2 story, basement, brick, steel, rein.-con. $230,000. Hacker & Hacker, 201 Main St., Fort Lee, archts.

R. I., Providence—Oct. 26, by City, Pub. Building Dpt., City Hall, 2 story, basement, 70 x 200 ft. brick, steel school with 2 gymnasiums, auditorium, Windmill and Paul Sts. $900,000. T. J. H. Pierce, City Hall, archt.

N. J., Rahway—Bd. Educ., High School, bids about Dec. 1, Junior High School, 3 story, basement, brick, steel, Central Ave. $400,000. Seymour Williams, 146 Irving St., Rahway, archt. Noted Aug. 19.

N. J., Teaneck—Bd. Educ., High School, bids about Nov. 15, general contract 3 story, 100 x 220 ft., brick, steel, rein.-con. high school, Queen Ann Rd. $635,000. Hacker & Hacker, 201 Main St., Fort Lee, archts. Noted Sept. 10.

N. J., Teaneck—Bd. Educ., High School, bids about No. 15, 2 story, basement, 45 x 80 ft. and 55 x 200 ft., brick, steel, Garrison Ave. $200,000. N. T. Anthony, 275 Engle St., Englewood, archts. Smith & Ward, 100 East 42nd St., New York, assoc. archts. Noted Sept. 3.

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CONTRACTS AWARDED

Del., Dover—Bd. Trustees State College for Colored Students, H. V. Holomery, supt., State School Bldg., Comn., general contract 3 story, basement, 75 x 140 ft. x irregular sized, brick, steel, rein.con. dining hall, plain found., State College, to J. A. Bader & Co., Lackey Bldg., Wilmington; plumbing and heating, to T. T. Weldin & Sons, 916 Orange St., Wilmington; electrical work, to Arrow Electric Co., 5112 Whitby Ave., Phila., Pa. Est. $150,000. Noted Sept. 17.

Ill., Chicago—Northwestern University, Evanston, music hall, to Charles & Smith, c/o owners. Contractor awarded separate contracts. James Gamble Rogers, 154 East 46th St., New York, archts. Noted July 16.

Ill., Ottawa—Bd. Educ., 211 East Main St., C. H. Kinzman, secy., 1 and 3 story, 120 x 156 ft. and 120 x 156 ft. school to Pehrson Bros., 555 Gateway Bank Bldg., Minneapolis, Minn. Est. $300,000. Bids about Nov. 1, lighting fixtures, hardware. Noted July 9.

Ill., Peoria—Bd. Educ., general contract and equipment for Theodore Roosevelt Junior High School, to V. Jobst & Sons, Lehmann Bldg., $455,737 and $37,550 respectively; heating and ventilating, to Hitchcock Sprinkler & Heating Co., 811 South Washington St., $97,181; plumbing and plumbing equipment, to Crowley Bros., 312 North Madison St., $37,500 and $2,500 respectively. Grand total $630,468.

Ind., Gary—School Comrs. 3 story, basement, 187 x 295 ft., rein.-con., brick high school, to McDonald Constr. Co., 3408 Thomas St., St. Louis, Mo. Est. $1,000,000.

Ind., Tangier—School Comrs., general contract brick, steel, stone grade and high school, to C. Anstead, Clinton. Est. $150,000.

Md., Garrett Park—Georgetown Preparatory School, R. S. Lloyd, supervisor, 1 story, basement, brick, steel, concrete, chapel to C. U. Tompkins, 1608 K St., N.W., Wash., D. C. Est. exceeds $150,000. Noted Sept. 17.

Mass., Winchester—Town R. M. Stone, chn. Building Comn., 2 story, basement, brick, stone, Junior High School, plain found. Main St., to Delaney Constr. Co., Inc., Bay State Bldg., Lawrence. Est. $250,000. Noted Aug. 6.

N. J., Glen Gardner—Dpt. Institutions & Agencies, State House Annex, Trenton, general contract 1 story, basement, brick, rein.-con. school, to R. Riccardi Constr. Co., 348 North 6th St., Newark; plumbing, to A. M. Maddox, 234 Watchung Ave., Montclair; heating, to Nelson Piping & Equipment Co., Delancy St., Phila., Pa.; electrical work, to Hackenbury Electric Co., 29 East High School, Somerville; steel, to Bethlehem Constr. Co., 556 Main St., Bethlehem, Pa. Est. $150,000. Noted Sept. 18 Daily.

Wis., Milwaukee—Marquette University, concrete, masonry contract for 4 story, 145 x 260 ft. medical school, North 15th St., to Selzer-Ornst Co., 444 State St., Wawatosa.

Wis., Oshkosh—Bd. Educ., general contract Junior High School, 215 x 309 ft., to C. R. Meyer & Sons Co., Oshkosh, $164,920.

Wis., Whitefish Bay—Bd. Educ., excavating, concrete and carpentry work for 3 story, 80 x 260 ft. high school, Ardmore St., to P. Riesens Sons, 2660 North Humbolt Ave., Milwaukee, $189,075.

THEATRES

PROPOSED WORK

Fla., Miami—Paramount Public Theatre, Paramount Bldg., New York, theatre, Flager St. and 3rd Ave. To exceed $500,000. Project abandoned. Noted Mar. 19.

Mass., Brookline (br. Boston)—Corporation, c/o J. H. Bickford Co., archts., 6 Beacon St., Boston, will not build theatre, Beacon St. $150,-000. Project abandoned. Radio-Keith Orpheum Corp., 1564 Bway., New York, lessee.

N. J., Englewood—M and R Realty Co., S. Lippman, and L. Gottlieb, 491 East 27th St., Paterson, 2 story, basement, brick steel theatre, office, store, 16 West Palisade Ave. $150,000. Project indefinitely in abeyance. E. De Rosa, 18 East 41st St., New York, archts. Noted Sept. 17.

N. Y., Ossining—Fox Theatres, 850 10th Ave., New York, theatre. To exceed $150,000. **Maturity in spring or later.**

BIDS ASKED

Ind., Evansville—Dixie Realty Co., A. O. Hassensall, pres., Claremont Hotel Bldg., 127 Locust St., taking bids 3 story, basement, steel, hollow tile, 2nd and Sycamore Sts. $200,000. A. S. Graven, Inc., 100 North La Salle St., Chicago, Ill., archts. Noted Sept. 10.

Mass., Gloucester—J. D. Bloomberg, 83 Main St., taking bids 1 and 2 story, basement, 60 x 200 ft., brick, stone, steel theatre, store, 283 Main St. $150,000. Eisenberg & Feer, 11 Beacon St., Boston, archts.

N. J., Newark—Salmond Schrimshaw & Co., archts., 526 Elm St., Arlington, taking bids general contract altering and constructing 2 story, basement, brick, steel, theatre and stores, addition, Market and Ward Sts., for Fleissner Realty Co., c/o archts. $150,000.

BANKS

PROPOSED WORK

N. Y., Brooklyn—Lincoln Savings Bank, 531 Bway, soon lets contract 2 story, basement, 42 x 100 ft. Bank, Church and Nostrand Ave. $175,000. Koch & Wagner, 32 Court St., archts. Noted Oct. 8.

CONTRACTS AWARDED

Mass., East Cambridge—East Cambridge Savings Bank, 202 Cambridge St. 1 story, 60 x [illegible] ft., brick, granite, Cambridge St., to W[illegible] Bros., 150 Hampshire St., Cambridge. [illegible] $150,000.

N. Y., New York—Bowery Savings Bank, [illegible] East 42nd St., general contract 17 story [illegible] tion and alterations, to Marc Eidlitz & Son, [illegible] 100 East 42nd St. Est. $650,000. [illegible] Sept. 3.

OFFICES

PROPOSED WORK

Mich., Birmingham—Detroit Edison Co., 2[illegible] 2nd Blvd., Detroit, sketches 2 or more [illegible] brick, steel, rein.-con., plain found. $250,[illegible] Private plans by Owners Eng. Dpt.

BIDS ASKED

Ore., Portland—See "Contracts Awarded."

CONTRACTS AWARDED

N. J., Weehawken—New York Central R.R. Co., F. B. Freeman, ch. engr., 466 Lexington Ave., New York, general contract 2 story, basement, brick, steel office, to E. J. Duffy, 17th Ave. and 42nd St., New York. Est. $150,000. Noted Sept. 17.

Ore., Portland—Mrs. E. N. Yeon, rebuilding Yeon Building, 14 story, basement, 50 x 100 ft. office, 5th and Stark Sts., day labor. DeYoung, Rosenberg & Moscowitz, 350 Salmon St., archts.

STORES

PROPOSED WORK

Mass., Gloucester—See "Theatres."

N. J., Westfield—Owner, c/o H. V. Trevenen, archt., 116 Elm St., sketches 2 story, basement, brick, steel store, office. $150,000.

N. Y., Long Island City—Bradard Land Corp., 39-35 Queens Blvd., plans by A. Farber, 1746 Pitkin Ave., Brooklyn, 4 story store, apartment, Queens Blvd. and 39th Pl. $150,000.

CONTRACTS AWARDED

Ind., Hammond—J. Gordon, Chicago, Ill., general contract 2 story, basement, 60 x 140 ft. brick, steel, stone store, office to Louis Padeo & Son, 33 North La Salle St., Chicago Ill. Est. $150,000. Noted June 4.

Mass., Quincy—Mrs. E. J. Johnson, c/o Blackwell, Clapp, Whittmore & Clark, 31 West St., 4 story, basement, 50 x 120 ft. store, office to G. Gonia, 2 Greek Sq., Boston. Est. $150,000. Noted Oct. 8.

PUBLIC

PROPOSED WORK

Conn., Windsor—LIBRARY—Windsor Historical Society, C. Chamberlain, chn. building com., plans by C. F. Adams, Lewis and Gold Sts., Hartford, historical library and office building, $150,000. Noted Mar. 19.

N. J., Essex Fells—MUNICIPAL—Bd. Boro Council, Boro Hall, 2 story, basement, brick, steel addition, Roseland Ave. $150,000. **Maturity probably soon.**

N. J., Palisades Park—LIBRARY—Bd. Boro Council, Boro Hall, brick, steel library, $150,-000. **Maturity probably soon.** Architect not appointed.

N. J., Union—MUNICIPAL—Township Comn., Township Hall, will not build 2 story, basement, brick, steel, Morris Ave. $150,000. Project abandoned. F. A. Elsasser, Morris Ave., archt. Noted July 9.

BIDS ASKED

Me., Bangor—ARMORY—Oct. 27, by Municipal Officers, at office of Mayor, City Hall, state armory. Noted Oct. 1.

N. Y., Ossining—Oct. 29, by Dpt. Correction, State Office Bldg., Albany, segregation building and connecting corridor, Sing Sing Prison.

CONTRACTS AWARDED

Calif., Oakland — EXPOSITION — W. W. Campbell, city clk., 1 story, steel, rein.-con., to R. W. Littlefield, 337 17th St., $135,000. Noted Aug. 14.

UNCLASSIFIED

PROPOSED WORK

Mass., Somerville—LEGION—Somerville Post, American Legion, J. McCarron, chn. building com., plans by J. P. Hefferman, 175 High St., Boston, American Legion Building. $150,000.

Mo., Kirkwood—HOME—Masonic Home of Missouri, W. W. Martin, pres., 5357 Delmar Blvd., St. Louis, 10 cottages, gymnasium, chapel, Big Bend Rd. $500,000.

N. J., Elizabeth—WELFARE HOME—Bd. Freeholders Union Co., Court House, 2 story, basement, brick, steel welfare home. $300,000. **Maturity probably in March.** Architect not appointed. Noted Sept. 24.

Pa., Phila. — RADIO and TELEVISION BROADCASTING STUDIO—Universal Broadcasting Co., L. Levy, pres., 1321 Arch St., plans by G. D. Roth, 1629 Chestnut St., 3 story, rein.-con., brick, steel atop 21 story Franklin Trust Co. Building, 15th and Chestnut Sts. $350,000.

Tex., Fort Worth—PASSENGER STATION, etc.—Santa Fe Ry. Co., W. W. Kelley, Amarillo, ch. engr. (Western Lines), soon lets contract 2 story, 91 x 246 ft. passenger station, and 2 and 3 story, basement, 50 x 140 ft., rein.con. brick freight house and train shed, Jones St.

Unclassified (Continued)

Wis., Appleton — MAUSOLEUM — Riverside Memorial Co., Odd Fellows Bldg., plans by Lovell & Lovell, c/o A. D. Smith, 729 East Franklin St., monolithic rein.-con. granite marble. $160,000.

CONTRACTS AWARDED

Calif., Sacramento—ORPHANAGE— St. Patrick's Orphanage, 2 story, basement, rein.-con., to Azevedo & Sarmento, 920 O St., $196,666. Noted June 19.

Calif., Westgate—HOME for AGED—Eastern Star Home of California, North Fairoaks and Pasadena Sts., 2 story, basement, rein.-con., to Bradley Constr. Co., 1833 West Pico St. $250,000. Noted Aug. 20.

Tex., Fort Worth—FREIGHT DEPOT, etc.— Texas & Pacific Ry. Co., E. F. Mitchell, ch. engr., Dallas. 1 story, outbound freight depot and transfer platform, to R. F. Ball, Elect. Bldg. Est. $120,000.

Industrial Buildings

FACTORIES AND MILLS

PROPOSED WORK

Calif., Alameda—GLASS FACTORY—Owens-Illinois Glass Co., W. I. Cole, mgr., 133 Kearny St., San Francisco, plans by Mills, Rhines, Bellman & Nordhoff, Inc., Ohio Bldg., Toledo, O., group factory buildings on 10.5 acre site. $1,000,000. Noted July 9.

Calif., Bay Point—FACTORY—Congoleum-Nairn, Inc., 195 Belgrave Dr., Kearny, N. J., preliminary studies by Sanderson & Porter, 52 Williams St., New York, manufacturing plant, incl. power plant. • To exceed $1,000,000. Noted Sept. 3.

Calif., Santa Paula—PACKING PLANT—Limoneira Co., 117 North 10th St., plans by R. C. Wilson, 112 South Mill St., 1 story, basement, rein.-con. addition. $70,000.

Calif., Southgate—BATTERY FACTORY—Firestone Tire & Rubber Co., Manchester Ave. and Alameda St., Los Angeles, sketches factory. To exceed $150,000.

Conn., Bridgeport—FACTORY—Kaplan Bros., 146 Knowlton St., plans by C. F. Davis, 1024 Main St., 2 story, brick addition. $40,000.

Idaho, Priest River—CHEMICAL PLANT—Pacific States Pulp & Paper Co., c/o L. E. Van Winkle, secy., 414 Fernell Bldg., Spokane, Wash., (1st unit) chemical plant. $50,000. Total $1,000,000.

Md., Baltimore — BULK OIL PLANT — Sun Oil Co., 1608 Walnut St., Phila., bulk oil plant, Haines and Warner Sts. $60,000.

Mass., Northampton—BAKERY—Smith College, F. King, sup. buildings, 2 story, 55 x 190 ft., brick, concrete. $50,000. Architect not appointed.

Mo., St. Louis—BAKING PLANT—Kroger Grocery & Baking Co., 75 East 7th St., Cincinnati, O., soon lets contract baking plant, incl. flour storage, facilities. To exceed $500,000.

N. H., New Dunham—ENAMEL FACTORY—Allen Mfg. Co. sketches rebuilding plant, recently destroyed by fire. $25,000-$40,000 loss.

N. Y., New York—PUMP HOUSE—Consolidated Gas Co., 4 Irving Pl., plans by J. F. Hunter, c/o owner, pump house, Hunts Point Ave. and Bronx River. $50,000.

N. Y., New York—FACTORY—Lebanon Natl. Kosher Sausage Factory, 224 East 6th St., garage, West Farms Rd. and 173rd St. **Maturity in March.** R. Shutkind, 147 4th Ave., archt. Noted Sept. 3.

N. Y., New York—FACTORY—P. Sowada, 369 Palmer Ave., Yonkers, plans by E. Gower, 135 Fortfield Ave., Yonkers, 2 story, 44 x 103 ft. factory, 239th St. and Bullard Ave. $40,000.

N. Y., Ridgewood—FACTORY—Muller Paper Goods Co., 2350 Linden Blvd., soon lets general and separate contracts altering and constructing plant addition. $75,000. H. Brucker, 1037 Kossuth Rd., Glendale, archt.

Tenn., Hollywood (br. Memphis)—FEED MILL—G. E. Conkey Co., 6529 Bway., Cleveland, O., stock dairy and poultry feed mill. $200,000.

Texas—OIL REFINERY—Hartman Interests, Inc., c/o E. W. Hartman, pres., 25,000 bbl. daily oil refining plant on channel between Houston and Galveston. $3,000,000. Private plans.

Tex., Brownsville — PACKING PLANT — Lovett & Kirk, West Rowson St., San Benito, soon lets contract 1 story, 40 x 120 ft., concrete, sheetrock and textone, Southern Pacific right-of-way. Private plans.

Tex., Galveston—FACTORY—Woocal Worsted Co., W. N. Campbell, pres., Sanford, Md., sketches Palm Beach clothing manufacturing plant. $250,000.

Tex., Kingsville—PLANT—Carrot Products Co., c/o C. M. Haskell, Oklahoma City, Okla., 1 and 2 story, 60 x 160 ft. carrot processing plant. $100,000. Private plans. Aiken & Vermerseh, Deemer St., San Antonio, may build same.

Tex., Primera—PACKING PLANT—Rio Grande Vegetable Cooperative Assn., c/o G. Warren, McAllen, soon lets contract 1 and 2 story, sheet rock, Texas stone, concrete packing plant. Private plans.

Vt., Westminster—FACTOEY—C. H. Baxter & Bros. Co., Main St., Brunswick, Me., sketches rebuilding canning factory. To exceed $50,000. Architect not appointed.

Wis., Kaukauna—PLANT, etc. — Thilmary Pulp & Paper Co., M. A. Wertheimer, pres., sketches 2 story rein.-con. plant, warehouse and office building. $40,000. Architect not appointed.

Wis., Tomahawk—NEWSPAPER PLANT—Toomahawk Leader sketches by Appenhamer & Abel, Bellin Bldg., Green Bay, 1 story, basement, 60 x 140 ft., rein.-con., brick.

BIDS ASKED

N. J., Raritan—FACTORY—H. Bulkin, North Bridge St., taking bids on separate contracts 1 story, basement, 60 x 150 ft., brick, steel. $40,000. P. C. Van Nuys, 1 West Main St., Somerville, archt.

O., Bascom—FACTORY—Gem Mfg. Co. bids about Nov. 2, 1 story, 40 x 180 ft., brick, steel. $40,000. Private plans.

Tex., Brownsville — PACKING PLANT— Southern Pacific R.R. Co., c/o P. Shoup, pres., 65 Market St., San Francisco, Calif., G. W. Boschke, ch. engr., taking bids 1 story packing plant on Southern Pacific right-of-way.

Tex., Corpus Christi—CHEMICAL PLANT—Southern Alkali Corp., H. A. Galt, 535 5th Ave., New York, bids about Jan. 1 (1st unit), chemical plant. Total est. $10,000,000. Noted Aug. 13.

Tex., Edcouch — PACKING PLANT — Rio Grande Vegetable Co-operative Assn., c/o R. Hartness, McAllen, bids about Nov. 1, master vegetable packing plant. Private plans.

Tex., Edinburg — PACKING PLANT — Rio Grande Vegetable Co-operative Assn., c/o R. Hartness, McAllen, bids about Nov. 1, master vegetable packing plant. Private plans.

Tex., Harlingen — PACKING PLANT — Southern Pacific R.R. Co., c/o P. Shoup, pres., 65 Market St., San Francisco, Calif., G. W. Boschke, ch. engr., taking bids 1 storg packing plant on Southern Pacific right-of-way.

Tex., McAllen — PACKING PLANT — Rio Grande Vegetable Coo-perative Assn., c/o R. Hartness, McAllen, bids about Nov. 1, master packing plant. Private plans.

Wis., Menasha—PLANT—Appleton Engraving Co., 348 West Water St., and Lee & Gmeiner, archts., 601 West College St., Appleton, taking bids 1 story, basement, 65 x 115 ft., rein.-con., brick, steel plant. $40,000. Noted Sept. 3.

CONTRACTS AWARDED

Calif., Santa Ana—SHEET GLASS FACTORY—Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa., brick, steel factory on 80 acre site, Fairview and Bristol Sts., to Stone & Webster, 601 West 5th St., Los Angeles. Est. $4,000,000. Noted Dec. 18.

Ind. Columbia City—FACTORY—Globe-Superior Co., general contract 2 story, basement, 80 x 200 ft., brick, steel, to M. P. Hodges, Warsaw. Est. $45,000.

Mass., Hyannis—PLANT—Dutchland Farms, H. Cox, mgr., 2 story addition and alterations, Scudder Ave. and Centreville Rd., to H. J. Beal & Son, 36 George St., Rockland. Est. $40,000.

O., Galion—FACTORY—W. H. Hatch, archt. and engr., Hippodrome Annex Bldg., Cleveland, 1 story, 90 x 220 ft., brick, steel to T. J. Schirtzinger 1353 North High St., Columbus, for Gledhill Road Mchy. Co., E. C. Gledhill, pres. Est. $50,000. Noted Aug. 20.

Pa., Johnstown—BULK OIL PLANT—Standard Oil Co. of Pennsylvania, W. E. Black, in charge, Peoples Gas Bldg., Pittsburgh, 1 story, 32 x 89 ft. brick, concrete, hollow tile garage and office building, founds. for vertical and horizontal tanks, paving founds. for 1 story, 50 x 100 ft. steel and metal covered warehouse, 2 loading platforms, septic tank and sewage disposal system, founds. for tile fire walls, to Wilson Constr. Co., Schenkemeyer Bldg., Bedford St.

Pa., Perkasie—FACTORY—H. E. Grim, 1 story, basement, 40 x 103 ft., brick, steel, plain found., to A. S. Mengle, Perkasie Ward-Davidson Co., Lehigh and Howard Sts., Phila., lessee.

W. Va., Newell—FACTORY—Edwin M. Knowles Chica Co., brick, steel factory units to house new tunnel kiln, to J. Finley Co., Chester, $40,000. Noted Sept. 17.

Que., Montreal East—SEPARATOR—Imperial Oil Refinery, Ltd., rein.-con., to W. G. Hunt, Ltd., 1405 Bishop St., Montreal. $50,000.

GARAGES

PROPOSED WORK

Conn., Bridgeport—White Line Bus Corp., 4490 Main St., plans by L. Asheim, 211 State St., 1 story, 80 x 120 ft., brick, steel, concrete bus garage addition, incl. overhead doors, traveling crane. Est. $40,000.

Mass., Lawrence—Able Bros., c/o J. G. Morissette, archt., 575 Essex St., altering and constructing 1 story, concrete block, steel service garage addition, Jordan St. $40,000.

N. Y., Brooklyn—Reid Ice Cream Corp., 542 Waverly Ave., plans by J. E. Ross, 25 West 43rd St., 1 story, 95 x 99 ft. service garage, Waverly Ave. and Fulton St. $40,000.

N. Y., Elmhurst—J. C. Trumpfeller & Sons, 47th Ave. and Queens Blvd., bids late in winter or spring, 2 story, 38 x 65 ft. service garage, 47th Ave. and Queens Blvd. $40,000. C. Hendry, 8304 Baxter St., Jackson Heights, archt.

N. Y., Queens Village — Queens Carmel Gardens, Inc., 250 Crown St., Brooklyn, plans by B. Braunstein, 163-18 Jamaica Ave., Jamaica, 1 story, 164 x 237 ft. service garage, store, 222nd St. and Jamaica Ave. $60,000.

O., Cleveland—Greyhound Management Co., O. S. Ceasar, pres., 1783 East 11th St., plans by R. Cummins, c/o owner, 1 story, 100 x 500 ft., brick, steel garage. $200,000.

Pa., Chester—Ford Motor Co., rebuilding assembling plant, damaged by fire. To exceed $100,000.

Pa., Donora—A. Zeffiro, 106 Keurie Ave., plans by C. C. Compton, Donora, 1 story, 44 x 100 ft., steel, rein.-con. garage, 8th St. and Meldon Ave.

BIDS ASKED

N. Y., Ozone Park—See "Contracts Awarded."

Utah, Salt Lake City—Lauren W. Gibbs, c/o Amer. Thrift Corp., taking bids 1 story, basement, brick, steel bus garage. $40,000. Young & Hansen, McCormick Bldg., archts.

CONTRACTS AWARDED

Mass., Medford—Boston Elevated Ry. Co., 31 St. James Ave., Boston, superstructure 1 story, 65 x 155 ft. and 30 x 35 ft., brick, steel bus garage to J. J. Powers Co., 33 Myrtle Ave., Cambridge. Est. $50,000. Noted Oct. 1.

N. Y., Ozone Park—S. LoPiccolo, 301 Covert St., Brooklyn, 1 story, 100 x 164 ft. service garage, Atlantic Ave. and 102nd St., separate contracts. To exceed $40,000. C. Cannella, 1163 Herkimer St., Brooklyn, archt.

N. Y., Woodhaven—Anheuser Busch, 929 Brooker Ave., New York, altering garage and manufacturing building 104th St., Atlantic and 94th Aves. to Equity Constr. Co., 25 West 43rd St., New York. Est. exceeds $40,000.

POWER AND LIGHTING

PROPOSED WORK

Calif., Bay Point—See "Factories and Mills."

Calif., Seal Beach—Los Angeles Gas & Electric Co., 810 South Flower St., Los Angeles, large addition to generating plant. Est. several million dollars.

Ind., Pendleton—Indiana Reformatory, R. Howard, supt., 3 story, basement, 80 x 160 ft. heating plant and trade school, State Reformatory. $90,000. Private plans.

Ind., Richmond—City appropriated $400,000 to purchase 15,000 kw. turbine with complementary equipment for electric plant. Noted Jan. 1.

Ind., Warsaw—City Council municipal light plant. $100,000.

Mass., Williamstown—Williams College, Main St. soon lets contract 1 story, brick, concrete power plant. $45,000. Lamsmore, Le Clear & Robbins, 31 St. James Ave., Boston, archts.

Minn., Duluth—J. J. Dwyer, genl. mgr. Duluth Steam Corp., soon takes bids, 8 story, 100 ft. high, 93 x 140 ft., concrete, brick, steel generating plant, incl. offices, boiler rooms to house four 85 hp. and three 1,000 hp. boilers, Lake Ave. and Commerce St. Total est. $1,500,000. Sullivan & Orfault, 408 Palladio Bldg., archts., R. D. Thomas, 1200 2nd Ave., S., Minneapolis, engr. Noted Jan. 15.

BIDS ASKED

N. D., Grafton—Oct. 27, by State Bd. Administration, E. G. Wagner, secy., 2 story, basement, rein.-con. brick power and heating plant addition, State Institute for Feeble-Minded. $150,000. T. B. Wells, Grand Forks, engr.

CONTRACTS AWARDED

Ind., Hartford City—School Comrs., brick, steel steam heating plant, to Hartford Hardware Co., Hartford City. Est. $40,000.

Mass., Boston—New England Hospital for Women, 40-50 Dimock St., 1 story, brick boiler room addition, to D. H. Jacobs, 77 Summer St.

Utah, Murray—City, two 725 hp. water wheels, to S. Morgan Smith Co., Salt Lake City, $8,590—two 625 kva. generators, to Westinghouse Electric Co., McCormick Bldg., Salt Lake City, $10,630. Noted Sept. 25 Daily, under "Dams."

WAREHOUSES

PROPOSED WORK

Minn., Minneapolis—City Council soon takes bids 1 story, basement, 66 x 116 ft., concrete, brick warehouse, repair shop, 3rd St., S. between 2nd and 3rd Aves. $35,000-$40,000. A. M. Larson, architectural engr. City Eng. Dpt.

N. Y., Brooklyn—Brooklyn Union Gas Co., 176 Remsen St., altering 2 story storage and garage, Varick and Maspeth Sts. $40,000 Private plans.

N. D., Fargo—White Eagle Oil Co., E. A. Radquist, div. engr., completed plans 1 story, 150 x 360 ft., brick, concrete, incl. four 15,000 gal. storage tanks, trackage, etc., 15th St. and 1st Ave. N. $35,000-$40,000.

BIDS ASKED

N. J., Perth Amboy—Ballinger & Co., archts., 12th and Chestnut Sts., Phila., Pa., bids about Oct. 15 on revised sketches 1 story, 165 x 260 x 460 ft., brick, steel, rein.-con. grocery warehouse Fayette St., for Greenspon Bros., 226 Washington St., Perth Amboy. Est. $300,000. Noted Apr. 23.

N. Y., New York—See "Contracts Awarded."

CONTRACTS AWARDED

N. Y., New York—One Hundred Six to One Hundred Eight Fulton Street Corp., 206 Bway., E. A. Cohen, pres., altering storage and loft manufacturing plant, new plumbing, 106 Fulton St. and 14 Dutch St., separate contracts. $40,000. C. N. Whinston, 2 Columbus Circle, archt. Noted Oct. 8.

See proposal advertising on page 66

Constr. News page 147

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